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'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

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ELEMENTARY LESSONS IN HORTICULTURE.

BY PROFESSOR J. R. GREEN, M.A.,
Late Examiner in Botany to the University of Cambridge, and
F. L. GREEN,
Late Science Mistress in the Clifton High School.

VII.—Fruits and Seeds and their Distribution.

We come now to the consideration of the fruit. It cannot be too clearly understood that the notion of a fruit as something to be eaten is a popular and inaccurate one. Many fruits, *e.g.* wall-flower pods, are in no part edible. In many other cases, which we shall presently discuss more fully, the part eaten is not the true fruit. We shall see, too, that fruits are sometimes mistaken for seeds, and seeds for fruits.

We have first, then, in consequence of this confusion, to determine clearly what is meant by a fruit. We have seen, in our consideration of the flower, that the part of the pistil, or gynœcium, containing the ovules, or unripe seed, is called the ovary. To the mature ovary, containing the ripened ovules, then known as *seeds*, we give the name of fruit. A true fruit results from the development of the ovary alone, but in several instances developed ovaries are surrounded by or imbedded in other structures, usually but inaccurately regarded as fruits; they are therefore called spurious, or false fruits (*pseudocarps*).

We may very well compare the strawberry, rose-hip, apple, and pear as simple examples of false fruits, each being formed from a single flower. Let us look first at the strawberry. The edible part consists of a rounded mass of pulp, surrounded at its base by a calyx, which, since it does not fall off as the fruit ripens, is called *persistent*. The small bodies we see scattered over the surface of the pulpy mass are popularly called 'seeds'; but since each one, when carefully examined, is found to bear the remains or scar of the style, and also when cut open to consist of a wall called the pericarp, enclosing a true seed, it is indisputable that they are true fruits. What, then, is the pulpy mass on which these fruits are borne? If a number of specimens are gathered in as many different stages between flower and fruit, we shall see that the *receptacle* on which the parts of the flower are borne gradually enlarges, and in course of time becomes pulpy, coloured, and delicious in flavour.

The red hip of the rose is in some respects similar to the strawberry. If a longitudinal section be made through it, we shall have before us a fleshy body in which are embedded bodies which in structure exactly resemble the true fruits of the strawberry. This fleshy body is the enlarged receptacle, but instead of being convex, like that of the strawberry, it is concave.

In the apple and pear we have examples of what are called *pomes*. We can see at a glance that they are inferior fruits, for the withered remains of the calyx and, in young fruit, the stamens, are found at the end opposite the stalk. If the pome be now cut through, either lengthways or across, we shall see three regions, popularly known as the flesh, the core, and the pips. The edible part, the flesh, is, as in the cases before examined, the enlarged receptacle. The core is an ovary composed of several united carpels, and having its lower half fused with the receptacle. The pips are seeds.

We may now compare the fig, pineapple, and mulberry, which, unlike the spurious fruits hitherto examined, result, not from a single flower, but from a number of flowers. They are called *collective* fruits.

A fig at first sight looks as if it were a fruit with a succulent pericarp containing a number of small dry seeds. If a fig, however, be gathered and cut across while young and green, it will be apparent that this is not the case. The pulpy portion will then be seen to be a common receptacle, deeply concave and nearly closed at the top, which bears numerous flowers on its surface. These flowers are of two kinds. The lower part of the receptacle is thickly crowded with pistillate flowers, each consisting of a perianth enclosing an ovary with a long style and branched stigma. The upper part bears the staminate flowers, each consisting of a perianth enclosing

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three stamens. The fig is therefore *hermaphrodite*. Its so-called 'seeds' are the true fruits.

The nature of the mulberry is clearly seen on comparing one of its short dense spikes of pistillate flowers with the so-called fruit. Each perianth has four leaves, arranged in two pairs, enclosing the superior pistil, the bifid stigma of which may still be seen when the so-called fruit is ripe. The persistent perianth leaves have then become succulent and juicy, forming the edible part of the mulberry. Each little red-swelling is the enlarged perianth surrounding a small hard fruit, popularly but erroneously called a seed.

The pineapple is also a collective fruit, each lozenge-shaped area in the outside corresponding to a single flower. The flowers are borne on a simple axis which grows on beyond them into a leafy stem. This, when rooted as a cutting, bears another pine-apple, and so on. The flowers through immemorial propagation in this way have become sterile and seedless. All the parts of the flowers, together with their bracts and the axis of the stem on which they are borne, blend in ripening into a fleshy juicy mass.

We pass now to the consideration of true fruits, which, according to their external appearance, may be grouped into two classes:—dry fruits, possessing a woody or tough pericarp or wall; and succulent fruits, the walls of which are more or less fleshy. It will be convenient to divide each of these two classes according as the fruits grouped under them are dehiscent, opening to liberate their seeds, or indehiscent, enclosing the seeds till germination.

We will glance first at those fruits which are dry and indehiscent and contain only one seed. When we have a fruit of this kind, composed of one carpel, free from the calyx and having a thin membranous wall free from the seed-coat, as in the strawberry and rose-hip, we give it the name of *achene*. Another common example is found in the buttercup, which has a number of achenes borne on a receptacle which does not become enlarged and fleshy. In the maize and all cereals and grasses we have a dry one-sided indehiscent caryopsis, which differs chiefly from the achene in the pericarp being closely adherent to the seed-coat. The fruit of the sunflower and dandelion differs from that of cereals and grasses by being inferior, that is, by having the tube of the calyx united with it, and by being formed from two coherent carpels. It is called a cypsela. Now, let us look at a table fruit—the nut. We see that it is a superior fruit. The pericarp has become woody, and on cracking it we see that it is free from the coat of the kernel—the seed-coat. We have now to consider whether it is composed of a single carpel, as in the achene, or whether it is formed by the union of two or more carpels. Though one-celled and one-seeded, it is produced from an ovary of two or more cells with one or more ovules in each, all but a single ovule and cell having disappeared during its growth. It is therefore a *syncarpous* fruit. The nut is often enclosed or surrounded by a ring of bracts called a *cupule*, as in the acorn, where it forms a cup, in the chestnut, forming the bur, and in the hazel, where it forms a leaf-like covering.

It must not be supposed, however, that all dry indehiscent fruits contain but one seed, as in the examples just considered. Let us look at a very familiar fruit, that of the Indian cress, the nasturtium of our gardens. It consists at first of three one-seeded parts, from the centre of which springs the style, and on ripening it splits, scattering its parts. Such a splitting fruit is called a *schizocarp*, and its one-seeded component parts are termed *mericarps*. Many other examples of this kind of fruit are to be found in any ordinary garden. In the carrot and parsnip we have two *mericarps* applied face to face, which, when ripe, separate in consequence of the longitudinal splitting of the schizocarp. In the maple and sycamore the two mericarps are winged, and receive the name of *samaras*. Another interesting example is found in the fruit of the mallow, known to all country children as 'cheeses.' When ripe it splits into several mericarps.

We come now to dehiscent dry fruits, the pericarp of which opens at maturity to liberate the seeds, which are generally several in number and are enclosed by hard or thick coats. If we gather the fruits of the larkspur, the columbine, the pæony, and the monks-hood, we shall see that externally they closely resemble the familiar pods of the pea, bean, wisteria, gorse, and broom. In the first place, all these fruits are formed of but one carpel, and they are superior, or free from the calyx, as may be seen on looking at very young examples. Now, however, on examining their dehiscence, or mode of opening, we shall see an important difference. The *follicles* of the larkspur, &c., split open by their *ventral sutures* only, *i.e.*, the thickened edges of the folded carpellary leaf bearing the ovules. The pod, or *legume*, of the pea, &c., opens not only by the ventral suture, but also by the dorsal suture, which corresponds to the midrib of the folded carpellary leaf.

The interesting order of *Cruciferæ* or cress-worts, which includes among its members such popular garden flowers as the wall-flower and stock, and the serviceable vegetables, cabbage, broccoli, horse-radish, turnip, radish, and watercress, has a fruit somewhat resembling the above in appearance. Unlike them, however, it is formed by the union of two carpels, and its chamber is divided into two by an outgrowth from the wall of the ovary, called a *replum*, or *spurious dissepiment*. Where the fruit of the cress-worts is long, as in the wall-flower and cabbage, it is called a *siliqua*; where it is short and broad, as in the horse-radish, it receives the name of *silicula*.

We have now to examine the *capsule*, a fruit formed by the union of two or more carpels, and dehiscing longitudinally with the formation of teeth or valves for a greater or less distance from the top, or transversely, or by pores. Let us look first at the fruit of the lily and the foxglove. In the former we have three, in the latter two, carpels fused together and forming, in the first case, a three-chambered, in the second case a two-chambered, ovary. In the foxglove the constituent carpels separate where united, *i.e.*, at their ventral sutures, the dissepiments splitting. In the lily the carpels split along their dorsal margins, and the dissepiments separate from one another. The fruits of the tulip and iris are exactly similar to those of the lily. In the fruit of the rhododendron, on the splitting of the dorsal margins the dissepiments remain united, forming a column in the centre of the flower. In the violet there is but one chamber, and the carpels split along their midribs. In the primrose and pink, dehiscence is confined to the apex of the capsule, the pericarp splitting partially from

the top into *teeth*. Where the capsule dehisces transversely—not longitudinally, as in the examples hitherto considered,—as in the pretty little garden weed, the scarlet pimpernel, the henbane, and the plantain, a lid falls off. The third mode of dehiscence, by pores, is best seen in the capsule of the poppy. The fruit of the campanula and of the snapdragon also dehisces in this way.

Under the heading of succulent fruits—fruits the pericarp of which is more or less fleshy—come nearly all our table fruits. Like dry fruits, they may be either dehiscent or indehiscent. The cherry, plum, peach, apricot, nectarine may represent our first class of indehiscent succulent fruits. They are stone fruits, or *drupes*, and agree in the following characteristics:—They are superior, or free from the calyx, and they contain but one seed, which is surrounded by a pericarp consisting of three layers; the outer layer of epidemis, or skin, is known as the *epicarp*, the middle layer, which is succulent and edible, is called the *mesocarp*, and the innermost layer, the *endocarp*, is hard and thick, forming the wall of the stone. The seed is the kernel, and possesses a thin seed-coat. Akin to these stone-fruits, but differing in the bursting and liberating of the seed by the pericarp, is the fruit of the walnut, which forms a dehiscent drupe. There the epicarp and fleshy mesocarp burst to liberate the seed, which is still enclosed in the hard endocarp, popularly termed the 'shell' of the walnut.

The berry furnishes us with several table-fruits, *e.g.*, the grape, date, gooseberry, currant, melon, and a so-called vegetable, the cucumber. The raspberry and blackberry, it must be carefully noted, are not berries; they are really congeners of the plum, cherry, &c. They consist of a number of little drupes, or *drupels*, arranged on a slightly enlarged receptacle and forming an aggregate or collective fruit. If one of these drupels be cut across and examined under a good lens, it will be easy to distinguish the three layers of the pericarp and the single seed we found in stone fruits. The berry is one-chambered, like the drupe, but it is usually many-seeded, the epicarp, instead of being membranous, is tough, and the endocarp, as well as the mesocarp, is tough, surrounding the seeds which have firm coats. Sometimes the berry is superior, as in the case of the grape and date, more usually inferior, as may readily be seen in the goosebery, which are 'topped,' or deprived of the remains of the calyx before being cooked. The date has but one seed, and the endocarp is of a papery substance.

In the orange and lemon we have a fruit resembling in some particulars the berry. It is called a *hesperidium*. At the bottom of the fruit we can always see the scar left by the calyx, and sometimes the remnants of the calyx, and on the top of the fruit is a little round scar left by the style. It is, therefore, a superior fruit, developed solely from the ovary. On cutting it across we see a number of cells, each answering to a carpel. The yellow skin, the *epicarp*, and its lining, the *mesocarp*, form the rind or peel. The endocarp forms a thin membrane, from which numerous succulent hair structures have grown out, forming the pulp by which the chambers of the ovary are filled and the seeds surrounded.

We have seen that drupes are in some instances dehiscent. In the horse-chestnut we have an example of the succulent capsule. Here the prickly green husk is the pericarp, which, splitting into valves, sets free the seeds. In the sweet chestnut the prickly husk is formed by bracts, which have enlarged and grown over the 'nuts.'

We may now briefly examine the arrangement of the ovules in the ovary. The part of the ovary to which ovules are attached is called the *placenta*, whence their arrangement receives the name of *placentation*. On referring again to the legume of the pea, we see that the ovules are borne on the ventral suture, half on one edge, half on the other, each margin being alternately seed-bearing. The placentation is accordingly marginal. Now let us look again at the tulip, the foxglove, and the orange. These are all syncarpous pistils, formed by the union respectively of three, two, and many carpels. Since the carpels cohere, and the margins are folded inwards so as to meet in the centre of the pistil, the ovules are attached in the centre or axis, and the placentation is axile. In many syncarpous pistils the margins are not enfolded sufficiently to reach the centre, and these unite into an ovule-bearing axis. Such placentation is called *parietal*. An example is afforded by the pistil of the pretty border-plant diclytra. The placentation is also parietal in the cress-worts, *e.g.* stock, whose fruits we have examined. Sometimes, as in the violet, pansy, and gooseberry, the carpels are united by their edges without any folding, and since the ovules are borne on the walls of the ovary, the placentation is parietal. If we now make a cross-section through the young pistil of a pink, and through the ripe fruit, we shall see that the margins of the carpels are folded inward, but before the ovary is full grown the dissepiments disappear, causing the ovules to be collected in a head in the centre of the one-chambered ovary. Such placentation is called free-central. It also occurs in the primrose and cowslip. In these fruits, however, the dissepiments cannot be traced. In the water-lily we have a curious form of placentation which is called *superficial*, the ovules in that plant being scattered over the whole internal face of the carpels excepting the inner angle.

(*To be continued.*)

COMING MEN.

VII.—FRED. B. GILL, B.A. (Lond.).

Second Master Central Higher Grade School, Manchester; Member of the Executive of the N.U.T.; ex-President Manchester Assistants' Association.

It is the Sunday after the Saturday after the first Friday in the month (be it remembered this is how the date of the Executive meeting is fixed), and the Midland express is tearing its way to Cottonopolis. Our *vis-à-vis* is Mr. Fred. B. Gill, keen, alert, and withal sympathetic. The Union has no truer, and the assistants no more trusty and skilful general. In those peering orbs there is a merry twinkle that brightens those clear-cut features, and there is a combativeness in the well-reasoned utterances that calls to mind—

'A lickin's constitooshunal, pervidin' We don't get it.'

Our subject was born in the quaint old cathedral town of Chester, in the pedagogues' year of blight, 1862.

Coming to Manchester early in his career, he became a scholar, and afterwards a P.T., in Peter Street School under that venerable and enthusiastic Unionist, Mr. James Scotson. As a second year P.T. Mr. Gill attended the lectures on Political Economy at Owens College, and obtained the First Cobden Prize, and the next year followed this success with the Second Prize (£5) in the Senior Class for Schoolmasters. From that date he attended Evening Classes in Latin, Greek, Mechanics, and Mathematics at Owens, and matriculated at the London University during his apprenticeship, finally graduating in Arts.

'Don't you find the long day at Russell Square very trying?' is our query.

'About nine at night I begin to feel "fagged," but you see the work is very much lightened by its being so congenial, and so full of interest.'

'Your first year's experience has not damped your ardour.'

'Not by any means. I have been struck with the eagerness displayed to make the Union a living obstacle to oppression for all classes of teachers. No questions as to status are considered. I am more convinced now than ever that the salvation of the assistant teacher is within the Union. I was among the first to help forward the movement for improving the pay and position of the assistants in the provinces. From the first I was opposed to the idea of any formal union of assistants, as assistants, considering their sectional movement to be local rather than national in character. I advised the Manchester assistants to send delegates to the first Conference because the conveners distinctly declared there would be no attempt to float a new union or federation.'

'You opposed the Federation Scheme at Derby?'

'Quite true. In conjunction with Messrs. Hardy, Lang, Peaker, Sinclair, Verity, and lately Mr. Hicks, I have opposed these schemes from their inception. The National Union does not need the bulwark of a national federation. The assistant, too, has shown in the clearest possible manner his trust in the Union by joining in a larger proportion than probably any other class of teacher. Assistants' associations cannot hope to flourish except in large towns where there are great School Boards. In other places they will either be non-existent or be of a very transitory and evanescent character. There were fewer of these associations in existence at the Derby Conference than there were when the assistants met at Nottingham the year before. The associations which do not number more than 100 members will always find great difficulty in filling up gaps in the ranks of the officers who gradually drop out to become head teachers, &c. Federation may give a "fillip" to such.'

'What is your idea of the assistants' programme?'

'The past year has done much for the assistant, but there are still many disabilities under which he or she labours. The question of the administration of corporal punishment has progressed rapidly; the pay of the assistant is in a very unsatisfactory state, especially in the provinces. A scale of salaries ought to be real. Too often it is true that many teachers are "not on the scale." The scales are too low. The commencing salary where it is reasonable remains fixed for years. Under some School Boards assistants will reach the superannuation age ere they attain the maximum.'

'You say nothing about "Status."'

'Just so; I maintain that given decent remuneration and fair conditions the assistant will establish his status. It is one of those things you can only demand by inherent qualities—I had almost said virtues. I am sorry to find that the Federation is moved by some assistants to make one of its objects the determination of the exact professional status in the school of the head and assistant. This is almost the only object which clearly the National Union could not undertake, and it will be a sorry day for the profession as a whole when an attempt is made to force it to the front. The elevation of the teacher will not be gained by a guerilla warfare between sections and groups.'

Our subject became a teacher with the primary object of getting a good education. 'Yes,' he says, laughing, 'it is probably the most exacting and exhausting employment to engage in while gaining an education; but teaching has many compensations.'

When the Peter Street School was used he was first assistant, and became second master in the Central School when in 1884 it removed to its new home in Deansgate. He threw himself with enthusiasm into the instruction of the pupil teachers, of whom several matriculated in honours. The list of P.T.s and pupils who have matriculated and passed the Victoria University Preliminary Examination is growing quite a long one.

'And now about scientific teaching, Mr. Gill, for you must have had some experience in such a well-known science school.'

'My success as a science teacher has chiefly been in Mathematics, Stages III. and IV., and Theoretical Mechanics, in which latter subject my students have obtained upwards of 600 certificates.'

'Yes, as you suggest,' says Mr. Gill, 'much as South Kensington has done to encourage the teaching of science, the Department often plays the part of a hard and somewhat capricious foster-mother. The caprice and uncertainty of the South Kensington Examinations in Science and Art do much to mar good teaching. Whether viewed as an agency for determining the distribution of grant, or as a test of the acquisition of a certain quantity of knowledge, these examinations are open to the strongest criticism. Teachers whose classes have done well this last year must not be lulled into a sense of security and be willing to overlook the peccadilloes of a department which says the work done by 75 per cent. of the students (and those carefully selected) in several of the elementary subjects is not worthy of even "a pass." The plea that the number of papers is becoming overwhelming will no longer be available when the pupils in day schools are examined at special "*Day Examinations*," and when the work of the examiners becomes permanent instead of, as at present, the labour of three feverish weeks of overtime.'

'The Executive of the Union has asked you to make a "Special Report" on the vagaries of the Science and Art Department we understand.'

'I have nearly completed my task. I think some of the tables and returns I have prepared will prove to the Executive that the times are ripe for a great reformation, not in the teaching of Science and Art, but in the attitude and procedure of the South Kensington Department itself.'

Our friend is full of years, and well versed in educational politics. In a paper read in Manchester,

and since reprinted, he dealt with 'Some educational ideals from a teacher's point of view.'

In this admirable paper he says :—

'The teacher, too, has been adversely affected by these influences, but his emancipation approaches. The strength of the National Union of Teachers has greatly increased within the last fifteen years, and it has succeeded in gaining the ear of the Education Department. Further amelioration of the teacher's position is still needed. In the army, in the navy, in the medical, legal and clerical professions, official authority and responsibility rest in the hands of those who belong to that particular profession. How different is all this in connection with our system of state education. The chief officials at Whitehall, the confidential advisers of successive Education Secretaries, are without practical experience in the teaching and managing of an elementary school. No British-born gentleman, of good health, education, and character, is ineligible to become an inspector of schools except one who has been an elementary teacher. The qualifying diploma of the teacher is granted by the Education Department, and not, as it should be, by a professional council composed wholly or partially of the wisest and most learned of those who have been or actually are teachers. John Milton spoke of the profession in his day as "the slighted homely trade," and his words come to our minds to-day as a true description of the narrow and circumscribed career open as yet to the elementary teacher.'

Yours faithfully,
Fred. B. Gill.

And again :—

'Many other matters which adversely affect the teacher and his work are at present directly under the control of the Committee of Council and of the officials of the Education Department. Hence they can only be removed by the action of the Education Department.

'To briefly enumerate them, these defects are

'(1.) The inspectorate and all the higher official positions are absolutely inaccessible to the *experienced*, *successful*, and educated teacher. When this invidious bar is broken down codes will be produced and modified, and the teacher's work inspected by men who understand the difficulties as the teacher knows them.

'(2.) The teacher's certificate—his professional diploma—is granted by the Education Department, and not, as it ought to be, by a Council partly, if not wholly, composed of teachers.

'(3.) The training college accommodation has become totally inadequate. It is largely denominational, and not, as it should be, national. No "conscience clause" operates in these colleges, and students who gain inferior places on the scholarship list gain easy access to strictly denominational colleges, while there is not accommodation for those higher on the list at the undenominational and day training colleges. Thus, last year more than 5,000 pupil teachers passed the Queen's Scholarship Examination and qualified for admission to a training college, but there are *only* 1,900 *places in all the colleges* open to the students of one year.

'(4.) The "half-timer" ought to be abolished and compulsory attendance should become a reality. In order to facilitate these two reforms, teachers desire to see the time when small School Boards shall have given place to bodies of Managers having control over larger areas.

'(5.) For the sake of education, as well as to provide for the enfeebled schoolmaster, teachers desire *state-guaranteed* superannuation.'

Two years ago Mr. Gill was demanding that no department should be recognised for over 500 scholars, as will be seen from the extract below :—

'Finally, the school should be divided into workable departments. The time is coming when a definite answer will have to be given to the question : "What number should be the maximum department under one master or mistress?" This is more important than the question of departments—whether "boys, girls, infants," or "mixed (boys and girls) and infants." Whatever may be urged for mixed departments, surely it cannot be sound management to make a head-teacher responsible for more children in mixed schools than he (or she) would be responsible for if the children were all of one sex. Probably about 500 constitute as large a department as, under present conditions, an ordinarily gifted teacher, with a good staff, should be required to superintend. If it be urged the larger the school the more economical it is, it must be objected that it is false economy to ask the head-teacher to superintend a larger department than he can hope to keep in touch with and to influence. If 500 boys or girls are a sufficient charge for the best of our teachers, surely 700 or 800 boys and girls together constitute a charge too great for any but those of exceptional powers.'

No man round the table at Russell Square has a better grasp of educational politics, and no man brings a more shrewd, sympathetic, and intelligent mind to the solution of the many unsolved problems that arise. We have heard him plead for the removal of the disabilities imposed on non-college trained teachers at Whitehall, and we have seen him rouse a public meeting on the wrongs of the rural teachers. No man is more cognisant of the work done by the men who bore the heat and burden of the day. 'A prophet is not without honour save in his own country' is not true in the case of Mr. Gill. He has no firmer and more loyal supporters than his Manchester colleagues; and Lancashire is proud of its assistant representative. So long as the assistants send representatives so well versed in matters educational, so loyal, and so able as Mr. Gill, the cry will be, 'Come one, come all!'

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PAPERS FOR PUPIL TEACHERS.

BY JOHN ADAMS, M.A., B.SC., F.C.P., ETC.
Principal, Free Church Training College, Aberdeen.

PUPIL-TEACHERS AND THE BLACKBOARD.

Of all school apparatus the blackboard is probably the least skilfully used by all, and particularly by pupil-teachers. The latter are urged to make great use of the blackboard, an advice which they are not slow to follow. Only their advisers usually refrain from giving any help as to the 'how,' with the result that the pupil-teacher conscientiously and wearily writes out whole boardfuls of unnecessary and badly-arranged information.

To begin at the very beginning, you must not be afraid of your board. The most serious mistake in this matter is also the most common. It consists in writing too small and too light. For copy-setting purposes blackboard writing must show hair-lines and heavy downstrokes; in all other circumstances a broad line of uniform thickness is best. Don't be afraid to press heavily with your chalk. Big bold writing is the one essential element in blackboard writing.

With regard to the kind of board to use you can do nothing; that is for others to determine. But if you chance to have an old worn-out board with bald spots here and there (as some of you, no doubt, have), it may be worth your while to know that a few coppers' worth of ordinary black paint, mixed with turps instead of oil, will give you a capital preparation for renewing your board. This paint requires almost no time to dry. If laid on after school, it will present in the morning a fine dull uniform black. For a little while, at the beginning, the chalk will be difficult to remove; but that soon rights itself.

It is not quite unnecessary to say that you should not tamper with the board in this way without first acquainting the head-master with your intention. You see, some head-masters might resent your interference with school furniture; besides, it is just possible that the head-master may pay the necessary coppers.

The first thing to be done in using your board is to discover whether the whole class can see what is written on it. Many teachers think that because they have written clearly on the board what they themselves can easily read, therefore the class is bound to be able to read it too. As a matter of fact, there is nearly always quite a large percentage of a class that cannot make out distinctly what is placed on the board. This residuum of non-seers can be readily detected, and by carefully 'angling' the board, and redistributing your pupils, you can usually contrive that all shall see. A clever pupil-teacher knows exactly the 'seeing power' of every sitting-place in his class, and does his best to arrange his pupils accordingly.

Once you have got your blackboard into good working order, your next care must be to avoid using it too much. Nowadays there is such an outcry against mere rote-learning, and such a demand for the use of the eye as well as the ear, that the importance of the blackboard has been at least misunderstood, if not over-rated. Much time is mis-spent in writing down long lists of words, which by their very length defeat their purpose. The advantage of the board is that it singles out and emphasises certain difficulties. This advantage is entirely lost when long lists are used.

With an advanced class the 'heads' of a lesson may be profitably put on the blackboard; with junior classes the board should be mainly restricted to cases in which a new and exceptional word occurs, or in which several words have to be compared or contrasted.

Apart from the confusion and listlessness caused by an overfull blackboard, there is the serious disadvantage of weakened discipline.

While the teacher is busy writing on the blackboard, the class is left pretty much to itself. Under any circumstances, we have already seen, it is disastrous to leave a class even for a few moments with nothing to do. But the evil is increased a thousandfold when the idle moments occur while the teacher of necessity has his back to the class. We have here all the conditions favourable to bad discipline.

To get entirely rid of those difficulties is impossible, but we may so conduct our class as to render them less formidable. You must not make the mistake, so common among pupil-teachers, of regarding the act of writing on the board as a separate and independent thing. While something is being written

on the board everything else is usually suspended; when the writing is finished the lesson is resumed. Now it is precisely in this stop that the danger lies, and the stop should not be allowed to occur.

Sometimes quite a long set of words (say a few sentences for analysis, or to illustrate some rule in grammar) has to be put on the board. In all such cases the writing should be done before the lesson commences. As a rule, the board work done during the course of a lesson should be done strictly on the 'hand-to-mouth' principle. Even while his back is to his class, the teacher should go on with his explanations; he must be able to speak and write at the same time.

Many teachers can manage this quite comfortably, and maintain excellent discipline. But all are not equally gifted, so it is not amiss to point out the usual error of those who attempt this combination of writing and talking—it consists in thinking so much about the writing that the talking degenerates into an indistinct mumble, which only make matters worse by irritating the class.

It may not assist you very much to be told to speak slowly and distinctly, but I think the next hint will give you more practical help. The device is so simple that I am certain it must be in use somewhere, though I do not know of a single case in which it is applied. The nearest approach to it was the plan of the young professor of mathematics, who, while working at the blackboard, contrived to spot the ill-doers behind his back, by holding his eye-glasses so as to reflect the class in them.

My plan is simply to fix up an ordinary looking-glass in such a position that the teacher can command the whole class all the time that he is using the board. To me it is amazing that no enterprising manufacturer of school furniture has thought of letting in a couple of small mirrors at suitable places on blackboards or blackboard-stands. Fortunately, you do not need to depend on manufacturers; a six-penny looking-glass and a nail are all that you need. The glass may be fixed either to the board itself, to the board-stand, or to the school wall, according to the relative positions of teacher, board, and class.

Another device sometimes adopted to avoid working with the back to the class is to get some of the pupils to do the board work. With an advanced class, and as an occasional thing, this plan works admirably; but with young classes it is quite impracticable, except in the case of rudimentary drawings, of which I shall speak later. Even with advanced pupils care must be taken not to let the exercise degenerate into fun, which it is very apt to do from the smallness and queer shape of the figures, and particularly from the ridiculous squint that lines of figures always take in the hands of an inexperienced board-worker.

While the board is undoubtedly being too much used for the mere writing down of words and sentences, it is not half enough used for drawing. In fact, scarcely any teachers at all venture to draw on the board, and those who do draw, do it in quite a wrong way. This is clearly recognised by the Science and Art Department. For many years they have had an examination in blackboard drawing, an examination that was compulsory for those who aimed at the full Drawing Certificate D. Now this examination is voluntary, and seems likely to die out altogether. This has not resulted from any change in the Department's view of the importance of blackboard drawing, but from the fact that after striving with teachers for all those years, the Department has at length given up all hope of getting what it wants. Teachers *will* not do the sort of thing the Department demands. What it wants is a rough and ready, off-hand drawing of some common object, say a table or a watering can, knocked off in two or at most three minutes. What it gets is a laboured chair or can, not particularly like a chair or can, but having very fine lines, and showing traces of the friendly offices of the duster all over it, the drawing having taken at least twenty minutes.

This wrong view of the use of the board is not confined to the examination room. If a teacher has a lesson to give on, say, the palm-tree, he too often spends a long time beforehand making an elaborate picture in all the glory of coloured chalk. Now in the first place it is impossible to make a decent coloured picture with chalks on a blackboard—for anyone short of a pavement artist at least. And in the second place, it is undesirable. For if a drawing involves a considerable expenditure of time and skill, it is too valuable to be wasted on a passing illustration. The blackboard's function, indeed, is to supply rapid, not highly finished, sketches. In a University lecture-room, or in one of the blackboard-covered rooms in our newer schools, it may be possible to keep the same drawing for weeks on the board, but under ordinary circumstances a B.B. diagram has a short life and a merry one.

But the whole subject of drawing on the blackboard is far too wide and important to be trusted to a closing paragraph. It deserves an article to itself, and, if possible, a few illustrative sketches. We shall see what can be done in this way for our April Number.

OUR PUPIL TEACHERS' COURSE.

TYPICAL GRAMMAR QUESTIONS.—(*Continued*).

ii.—SECOND YEAR.—(*Continued*).

(Questions given previously for First Year, are not subsequently repeated).

(*c*) *Accidence, etc.*

(α) What is meant by *Gender* in Grammar? In what three ways is a change of gender in English generally denoted? Change the gender of drake, bride, horse, peacock, widow, sir, hero, emperor, and testator.

(β) Write out twelve words forming their plural by foreign methods.

(γ) What is the rule for forming the plurals of compounds and abbreviations?

(δ) What are demonstrative, distributive, and compound relative pronouns, and why are they so called? Give examples.

(ε) Define personal pronouns and give instances of four different kinds.

(ζ) Name the interrogative pronouns, giving instances. Wherein do they resemble and differ from the relative?

(η) Explain, with three examples of each, the terms *subjunctive mood, participial phrase, gerundive, potential, infinitive, passive, transitive,* and *participle.*

(θ) Give instances of participles that have become adjectives or prepositions.

(ι) Mention some adjectives often used as adverbs, and some words which are both adjectives and adverbs.

(κ) Give instances of adjectives with no positive degree.

(λ) Show the difference between an *adverb*, an *adverbial phrase*, and an *adverbial clause*. Add one of each to the sentence '*The wind blew.*'

(μ) How are adverbs compared? Compare *nigh*, *lovely*, *soft*.

(ν) Form some adverbs from *on*, *to*, *through*, *up*, *out*.

(ξ) Instance some prepositions used as adverbs, and then as adjectives.

(ο) Place after each of the following words the special preposition which is appropriate to it, and use it in a sentence of your own :—*Reconcile*, *differ*, *confer*, *conversant*, *independent*, *confide*, *absolve*, *dissent*, *prevail*, *adjacent*.

(π) Mention a few compound and a few phrasal prepositions.

(ρ) Classify conjunctions according to their origin, giving examples.

(σ) 'He came *after* I had gone.' Give reasons for showing that *after* may be regarded as a preposition, an adverb, or a conjunction. Which view do you incline to?

(τ) Make sentences containing *for*, *notwithstanding*, *but*, *since*, *until*, *except*, and parse the above words in every example.

(*d*) *Miscellaneous.*

(α) What is meant by inflexion? Give some examples, and show how the want of inflexions in our language is sometimes supplied.

(β) Cite three of the most important rules of syntax, and give illustrative sentences.

(γ) Say how you would explain the meaning of the term *case* to a class of children, and what sentences would you give in exemplification.

(δ) How many *cases* are there in English? In what ways can the *case* of a word be known? What parts of speech take *case*?

(ε) Give instances of the same word used as a collective noun and as a noun of multitude. In each case what is the number of the verb to which it is the subject?

(ζ) Explain and illustrate as to a class the difference between *co-ordinate* and *subordinate*, *active* and *passive*, *phrase* and *sentence*, *literal* and *figurative language*.

(η) What is a subordinate sentence? How many kinds are there? Give instances.

(θ) Explain the terms *factitive*, *opposition*, *accidence*, *antecedent*, *prepositional*, and *infinitive*.

(*e*) *Derivation.*

(α) Give a list of ten terminations by which you can tell that a word is derived from Latin. Explain their meaning and give examples.

(β) Give five of the principal Latin prefixes, and two or three examples of the use of each.

(γ) Give a list of the more important prefixes, both English and Latin, and illustrate your answer.

(δ) Make a list of words having the following beginnings :—*per*, *contra*, *ex*, *con*, *mis*, *ab*, *sub*, *pre*, *re*. Give three examples of each, and show the meaning of each part of the given compounds.

(ε) Make a list of words having the following endings :—*tion*, *fy*, *tude*, *ive*, *bleous*, *ose*, *ary*, *mony*. Give three examples of each, and show the meaning of each part of the given compounds.

(ζ) Explain the exact force and meanings of the syllables printed in italic in the following words :—*Pre*eminent, *preter*natural, *action*, *vice*-president, *efficient*, *responsive*, *visible*, *retro*spect, *pen*ultimate, *legal*, *im*proper, *per*forate, *re*fix, *e*volve, *non-con*formist, *sub*marine, *longitude*, *in*direct, *circum*location, *signify*, *pre*determined, *co*-operate, *de*duct, and give another example illustrating the use of the same prefix or affix.

(η) Give the meaning of each part of the following words :—*Aggregation*, *opponent*, *difference*, *attribute*, *indestructible*, *porosity*, *connexion*, *anticipate*, and *presuppose*.

(θ) Tell the meaning and use of the final syllable in each of following words, and say from what language each is derived :—*Leader*, *lambkin*, *clarify*, *regular*, *famous*, *saline*, *conversation*, *executrix*.

iii.—THIRD YEAR.

(Questions given previously for First or Second Year are not subsequently repeated).

(*a*) *Analysis and Parsing.*

(α) By labour and intent study, *which* I take *to be* my *portion* in this life, *joined* with the strong *propense* of nature, I might perhaps *leave something* so written to aftertimes *as* they *should* not willingly *let* die.

(β) When I *had once* addressed your *lordship* in public, I had *exhausted* all the arts of pleasing *which* a retired and uncourtly scholar can *possess*. I had done *all that I could*, and no man is well pleased to have his little all neglected, *be it* ever so *little*.

(γ) But *were* I Brutus,
And Brutus *Antony*, *there* were an *Antony*
Would ruffle *up* your spirits, and *put* a tongue
In every wound of Cæsar, *that should move*
The stones of Rome to rise and *mutiny*.

(δ) *There are* in this loud *stunning* tide
Of human care and crime,
With *whom* the melodies *abide*
Of the everlasting chime ;
Who *carry* music in *their* heart
Through dusky lane and wrangling *mart*,
Plying their daily task with *busier* feet,
Because their secret souls a holy *strain* repeat.

(ε) There's not a *joy* the world *can give like that* it takes away,
When the glow of early thought declines in feeling's dull decay ;
'Tis not on youth's smooth cheek alone the *blush which* fades so fast,
But the tender bloom of heart *is gone*, ere youth *itself be past*.

(ζ) On the smoke-wreaths, huge and slow,
That round her sable turrets flow,
The morning beams were *shed*,
And *tinged* them with a lustre *proud*,
Like that which streaks a thunder cloud.

(*b*) *Paraphrasing.*

(α) Lo ! the poor Indian, whose untutored mind
Sees God in clouds and hears Him in the wind.
His soul proud Science never taught to stray
Far as the Solar Walk or Milky Way.
Yet simple Nature to his hope has given
Beyond the cloud-topped hill a humbler heaven,
Some safer world in depths of woods embraced,
Some happier island in the watery waste,
Where slaves once more their native land behold,
No fiends torment, nor Christians thirst for gold.

(β) In lowly vale fast by a river's side,
With woody hill o'er hill encompassed round,
A most enchanting wizard did abide,
Than whom a fiend more fell is nowhere found.
It was, I ween, a lovely spot of ground ;
And there a season, atween June and May,
Half-prankt* with Spring, with Summer half imbrowned,
A listless climate made, where, sooth to say,
No living wight could work, nor cared even for play.
* *Decked-out.*

(γ) Since Cassius first did whet me against Cæsar
I have not slept.
Between the acting of a dreadful thing
And the first motion, all the interim is
Like a phantasma or a hideous dream.
The genius and the mortal instruments
Are then in council ; and the state of man,
Like to a little kingdom, suffers there
The nature of an insurrection.

(δ) Her court was pure ; her life serene ;
God gave her peace ; her land reposed ;
A thousand claims to reverence closed
In her as mother, wife, and queen,
And statesmen at her council met
Who knew the seasons, when to take
Occasion by the hand, and make
The bounds of freedom wider yet,
By shaping some august decree,
Which kept her throne unskaken still,
Broad based upon her people's will,
And compassed by the inviolate sea.

(ε) Tired Nature's sweet restorer, balmy Sleep,
He, like the world, his ready visit pays
Where fortune smiles; the wretched he forsakes;
Swift on his downy pinions flies from woe,
And lights on lids unsullied with a tear.
Night, Sable Goddess, from her ebon throne,
In rayless majesty now stretches forth
Her leaden sceptre o'er a slumbering world.
Silence how dead! and darkness how profound!
Nor eye, nor listening ear, an object finds;
Creation sleeps. 'Tis as the general pulse
Of Life stood still, and Nature made a pause—
An awful pause! prophetic of her end.

(ζ) Join voices, all ye living souls! ye birds,
That singing up to Heaven's gate ascend,
Bear on your wings and in your notes His praise.
Ye that in waters glide, and ye that walk
The earth, and stately tread or lowly creep!
Witness if I be silent, morn or even,
To hill or valley, fountain or fresh shade,
Made vocal by my song, and taught His praise.
Hail! universal Lord, be bounteous still
To give us only good; and if the night
Have gathered aught of evil, or concealed,
Disperse it, as now light expels the dark.

(*c*) *Accidence, Syntax, etc.*

(α) Give the plurals of *crisis, cherub, automaton, madam, monsieur, formula, genius, genus, die, sow.*

(β) When should the word *the* be considered an adverb? Give instances.

(γ) In how many ways may the definite and indefinite articles be used? Give examples.

(δ) Write out some rules respecting the use of the word *which.*

(ε) In how many different ways may the word *that* be used?

(ζ) When may the word *as* be substituted for the relative pronoun? Give instances.

(η) Explain and illustrate these statements:—
(1) Two negatives make an affirmative.
(2) Relatives must agree with their antecedents.
(3) The infinitive is often equal to a noun.
(4) The subject of a sentence may be enlarged by a word, or phrase, or another sentence.

(θ) Give instances of the adverbial objective.

(ι) Give instances of the omitted relative pronoun, and of omitted antecedent.

(κ) Give examples of participial phrases, and of adverbial sentences, and point out the principal varieties of the latter.

(λ) Give two examples (1) of noun sentences, (2) of adjective sentences. Say also when a phrase beginning with a preposition is adjectival, and when adverbial.

(μ) What kind of sentences are those which are introduced respectively by the following words:—*Nevertheless, since, because, if, for, but, as, where?*

(ν) Explain with full illustrations the following terms:—*Root, suffix, participle, indirect object, co-ordinate sentence, completion of predicate, adjective sentence, infinitive of purpose, passive voice, elliptical, demonstrative, superlative, subjunctive, nominative absolute,* and *paradigm.*

(ξ) What is the ordinary position of the different cases when used in a sentence? Give examples of displacement.

(ο) What is the usual position of the adjective—of the preposition? Give instances of poetical or idiomatic displacement.

(π) What adjectives are incapable of 'comparison'?

(ρ) What is meant by 'the sequence of tenses'?

(*d*) *Corrections, criticisms, etc.*

If there be anything wrong in the following sentences, correct it, and give your reasons:—
(1) There let him lay.
(2) No female is permitted to approach Mount Athos.
(3) A mutual silence prevailed for some time.
(4) He brought me a verbal message.
(5) I like him as well or better than his brother.
(6) He intended to have written to me yesterday.
(7) I quite agree with you.
(8) Nobody will miss him like I shall.
(9) He is a good sort of man.
(10) The committee were divided in opinion.
(11) The sad faces and joyous music formed an incongruous sight.
(12) It was almost intolerable to be borne.
(13) Neither his conduct nor his language appear to me to be satisfactory.
(14) If that I thought he would not come, I would no longer stay.
(15) I rarely or ever see him now.
(16) Mr. Jones and myself had decided to travel together.
(17) I shall have great pleasure in accepting your invitation.
(18) I should like much to have seen him.
(19) He was strongly averse to the proposal.
(20) I differ with you entirely.
(21) Scarcely had he gone, than his brother arrived.
(22) 'Yet to their general's voice they soon obeyed.'
(23) From whence do you come?
(24) There are people here whom you would think are very distinguished.
(25) 'The nations not so blest as thee
Must in their turn to tyrants fall.'
(26) This is the man whom I thought was a hero.
(27) Let you and I endeavour to set it right.
(28) The board of directors are incompetent.
(29) I said that John was better than him.
(30) James is my authority, than whom none know better.
(31) I differ wholly with the orator on that point.
(32) Who are you speaking of?

(*e*) *Derivation, etc.*

(α) Trace to their origin the following words, give their exact meaning, and employ each of them in a sentence of your own:—Reprehend, Methinks, Exportation, Audible, Literal, Distributive, Telephone, Atheist, Incarcerate, Behave, Auriferous, Forego, Thoroughfare, Subterranean, Centrifugal, Belligerent, Pre-eminence, Graminivorous, Photograph, Interrogative, Illimitable, Transportation, Forward, Edification, Victorious, Humourous, Philosopher, Ellipse, Extempore, Syllable, Unhappily, Continent, Witanagemote, Abroad, Precipitous, Translucent, Locomotive, Syntax, Phonograph, Overweening, Fortitude, Predetermination, Amity, Correlative, Intercession, Sinecure, Intelligible, Commodity, Declension, Intimidate, Defendant, Selfishness, Misunderstanding, Retrograde, Simultaneous, Disreputable, Dormitory, Conservative, Nutriment, Criss-cross, Invulnerable, Recognition, Foreknowledge, Compel, Uncouth, Appreciation.

(β) In the following passage select any words which you know to be of Latin origin, and give their exact meaning:—It may gratify curiosity to inform it, that the English Dictionary was written with little assistance from the learned, and without any patronage from the great; not in the soft obscurities of retirement, or under the shelter of academic bowers, but amid inconvenience and distraction, in sickness and in sorrow.

(γ) By what tokens can you often recognise at once, that a word is (1) of purely English, (2) of Latin, or (3) of Greek origin?

(δ) Select from paraphrasing passage (α) any words of Latin origin and give their derivations.

(ε) Select from paraphrasing passage (ε) any words of Latin or English origin and give their roots.

(ζ) Make a list of some common terminations of words derived from other foreign languages than Latin and give examples.

(η) Point out any words of foreign origin in paraphrasing passage (ζ), give their meaning, and explain their parts.

(θ) Give twelve Latin words with double prefixes.

(ι) Give with examples the different forms of *ad, con, in, ob, sub, para,* and *syn.*

(κ) Cite the corresponding Latin and Greek forms of *round, down, mid, over,* and *through.*

(*f*) *Miscellaneous.*

(α) Select from the various passages set for analysis and paraphrasing, any epithets which are not employed in a literal but in a figurative or poetical sense; and say how you would explain their appropriateness to a class of elder scholars.

(β) Are Anglo-Saxon and English different languages? or what is their relation to one another?

(γ) 'The ancient English is described as having been an inflexional language to a much greater extent than the English we now use.' Explain this statement, and mention any illustration thereof.

(δ) When did the following authors live, and what did they write:—Milton, Pope, Cowper, Hume, Coleridge, Macaulay?

(ε) Who were the principal English poets of the 17th century, and what were their principal works?

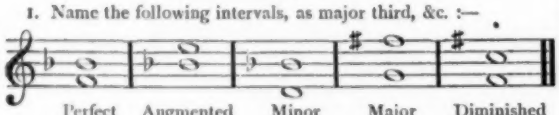
(ζ) What is meant by '*The Drama*'? Name six famous English writers and the names of any of their works.

MODEL ANSWERS
TO EXAMINATION OF 14TH OCTOBER 1893.

MUSIC.—STAFF NOTATION.

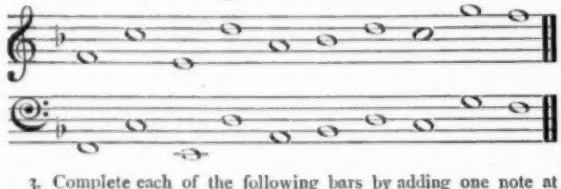
PUPIL-TEACHERS AT END OF FIRST YEAR.

1. Name the following intervals, as major third, &c.:—

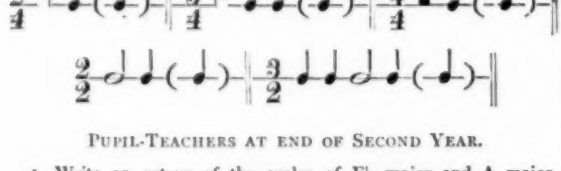


Perfect fourth. Augmented fourth. Minor sixth. Major seventh. Diminished fifth.

2. Re-write the following two octaves lower on the Bass Clef:—



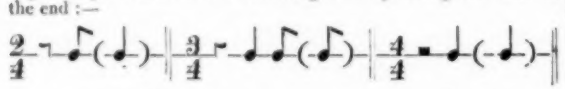
3. Complete each of the following bars by adding one note at the end:—



PUPIL-TEACHERS AT END OF SECOND YEAR.

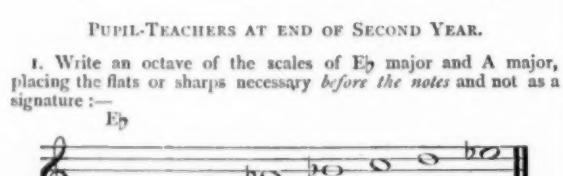
1. Write an octave of the scales of E♭ major and A major, placing the flats or sharps necessary *before the notes* and not as a signature:—

2. Name the following intervals:—



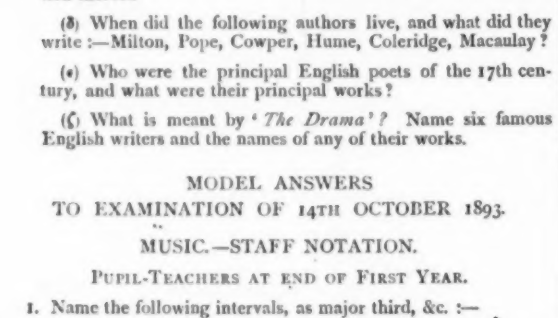
Major sixth. Diminished fifth. Major sixth. Major seventh. Minor sixth.

3. Complete each of the following bars by adding one *rest* at the end:—



PUPIL-TEACHERS AT END OF THIRD YEAR.

1. Write the sharps and flats of the following signatures in the customary order, and state for which *minor* keys they stand:—



2. Name the following intervals:—

Augmented second. Diminished seventh. Diminished fourth. Augmented fifth.

3. Re-write the following in $\frac{4}{2}$ time, doubling the value of every note and rest:—

TONIC SOL-FA NOTATION.

A quarter of an hour allowed for this paper.

END OF FIRST YEAR.

1. State between which tones of the following extended scale there are (*a*) major thirds, (*b*) minor thirds:—

d r m f s l t d' r'

Ans. (*a*) d—m f—l s—t
(*b*) r—f m—s l—d' t—r'

2. Re-write the following in four pulse measure, doubling the value of every note and rest:—

| d :- . | m :— | s .f : ‖

Ans. | d :— |— : | m :— |— :— |
| s :f | : ‖

3. What are the mental effects of the following scale sounds when sung slowly?

(*a*) *ray*. Prayerful, aspiring.
(*b*) *fah*. Grave.
(*c*) *te*. Bright, expectant.
(*d*) *lah*. Sad.
(*e*) *me*. Plaintive, calm, restful.

END OF SECOND YEAR.

1. Re-write the following passage, making a change to the first flat key at (*a*), and a return to the original key at (*b*):—

Key C.

(*a*) (*b*)
m f r d s ta m f l r f d' t d' r d
f.F. C.t.

Ans. m f r d sr f t1 d m l1 d sd' t d' r d

2. Name the following intervals:—

(*a*) *ray* to *fe*. Major third.
(*b*) *me* to *doh*1. Minor sixth.
(*c*) *soh* to *ta*. Minor third.
(*d*) *doh* to *lah*. Major sixth.
(*e*) *te*1 to *fe*. Perfect fifth.

Ans.

3. Write distinctly over each note and rest in the following its value in pulses or fractions of a pulse :—

1 $\frac{3}{8}$ $\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$ $\frac{3}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{2}$ 1

| d :m, -.f, | s :- . | s .,f :m ., | .r :d ‖

End of Third Year.

1. Name the following intervals :—

(*a*) *doh* to *se*. (*b*) *se* to *doh*^{1}. (*c*) *fah* to *se*. (*d*) *se*$_1$ to *fah*.

Ans. Augmented fifth. Diminished fourth. Augmented second. Diminished seventh.

2. Which of the following is highest and which lowest in pitch ?

(*a*) *fah* in Key G.
(*b*) *me* in Key B♭.
(*c*) *soh* in Key D.
(*d*) *te*$_1$ in Key C.
(*e*) *me*$_1$ in Key A♭.

Ans. (*b*) Highest. (*d*) Lowest.

3. Write out the following passage in four-pulse measure. The figures show duration in pulses or fractions of a pulse. Begin on a strong pulse.

$2\frac{3}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

m f s REST l s f m f t_i d REST

Ans. | m :— | - .,f :s . | l,s,f :m | f .t_i :d . ‖

TEST QUESTIONS.

First Year.

1. (*a*) Find the largest number that will divide both 153 and 177 without a remainder. Ans. 3.

(*b*) Find also the smallest number which is measured exactly by each of the above numbers. Ans. 9027.

(*c*) Show whether 211 is a prime number or not.
Ans. Not a prime number.

(*d*) Find by practice the weight of $187\frac{1}{2}$ loads of coal, each 1 ton 15 cwt. 3 qrs. Ans. 363 tons 5 cwt. 2 qrs. 14 lbs.

2. (*Boys.*) (*a*) Prove that $\frac{1}{4}$ of one unit is equal to $\frac{1}{7}$ of four units.

(*b*) What fraction of 10 miles is $\frac{3}{4}$ of $\frac{5}{6}$ of 18 yards?
Ans. $\frac{3}{616}$.

(*Girls.*) What must be given for 759 tons @ £1 13s. 10d. per ton? Work this sum by two methods.
Ans. £1,283 19s. 6d.

3. (*Boys.*) If A owns ·58 of a ship and B owns the rest; and if the difference in money value of their shares is £37·46, what is the value of the ship? Ans. £234 2s. 6d.

(*Girls.*) Make out the following account :—

	Answers. £	s.	d.
2 cwts. 0 qrs. 15 lbs. @ 3s. 8d. per lb.	43	16	4
480 lbs. 8 ozs. @ 12s. 10d. per qr.	11	0	$2\frac{1}{2}$
168 lbs. @ $9\frac{1}{2}$d. per lb.	6	13	0
17 kegs @ 19s. $11\frac{1}{2}$d. per keg.	16	19	$3\frac{1}{2}$
Total	78	8	$10\frac{1}{2}$

4. Write in Large-hand the words—
Frightened, Galaxy, Hypothesis, Ironical, Jesuit.
Write in Small-hand—
'The quick brown fox jumps over a lazy dog.'

5. Analyze the following lines and parse the italicised words—
'Those *eight* mighty daughters of the plough
Bent their broad faces *toward* us, and addressed
Their *motion*. *Twice I* sought *to plead* my cause,
But on my shoulders hung their heavy *hands*.'

6. (*a*) What are interrogative and relative pronouns? (*b*) Give examples of both; and also examples showing how the same word may serve both purposes. (*c*) Name some interrogative adverbs.

7. Describe the Saxon conquest of England.

8. Draw a political map of Scotland.

9. Say what you know of the following :—Plain of York, Fylde, Fens, Grampians, and Dartmoor.

10. (*a*) What is the theory of springs? (*b*) Explain the nature and causes of intermittent springs.

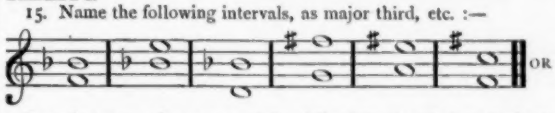
11. For what were the years 1002, 1008, 1016, 1041, 1051, and 1066 noted?

12. Who were Wilfred, Bede, Dunstan, Egbert, and Godwin

13. What events in English History are associated with Chippenham, Glastonbury, Whitby, and Stamford Bridge?

14. Draw up 12 Mental Arithmetic questions suitable for Standard I.

15. Name the following intervals, as major third, etc. :—



State between what tones of the following extended scale there are (*a*) major thirds, (*b*) minor thirds .—

d r m f s l t d' r'

16. Decline *celer equus*.

17. Give the enclitic prepositions.

Second Year.

1. (*Boys.*) A tradesman selling off advertises a reduction of 10 per cent. from his marked prices. At what price must he mark articles for which he wishes to obtain a net price of 5s. 3d.?
Ans. 5s. 10d.

(*Girls.*) By how much is $7\frac{1}{2}$ hrs. less than $\frac{3}{5}$ of $4\frac{1}{2}$ of $\frac{7}{11}$ of $\frac{5}{8}$ of 15 hrs. 2 mins.? Ans. 2 hrs. 4 mins.

2. (*Boys.*) If 7 per cent. be lost by selling goods for £145 6s. 3d., how much per cent. will be gained by selling them for £168 15s. 0d.?
Ans. 8 per cent.

(*Girls.*) A party of men, women, and boys, 32 of each, earn £235 4s. Find what each man, woman, and boy earns, a man earning twice as much as a woman, and a woman twice as much as a boy. Ans. £4 4s.; £2 2s.; £1 1s.

3. *Silver was in demand at* $41\frac{5}{8}$*d., showing a rise of* $\frac{1}{16}$*d. per ounce.* What was the value of 1,000 ounces before the rise in the price? Ans. £173 3s. $6\frac{1}{2}$d.

4. As in First Year.

5. Re-write the following passage in words of your own :—

'How many thousands of my poorest subjects
Are at this hour asleep! O gentle Sleep,
Nature's soft nurse, how have I frighted thee,
That thou no more wilt weigh my eyelids down,
And steep my senses in forgetfulness?
Why rather, Sleep, liest thou in smoky cribs,
Upon uneasy pallets *stretching* thee,
And *hushed* with buzzing night-flies to *thy* slumber,
Than in the perfumed chamber of the *great*,
Under the canopies of costly state,
And *lulled* with sounds of *sweetest* melody?'

6. Analyse the first five lines of the above passage, and parse the italicised words.

7. Explain and illustrate the terms *potential*, *infinitive*, *passive voice*, and *participle*.

8. Draw a map of the European coast from Calais to Venice, marking in only the capes, inlets, and ports.

9. Say what you know of the climate and productions of British South Africa.

10. Where are these places to be found—*Sebastopol*, *Kurrachee*, *Colombo*, *The Hague*, *Adrianople*, *Versailles*, *Gozo*, *Gottenburg*, and *Genoa*?

11. Give dates of First Statute of Westminster, Execution of Wallace and Piers Gaveston, Battles of Halidon Hill and Crecy, and Wat Tyler's insurrection.

12. What led to Henry IV.'s accession? Was it a good thing for England?

13. Describe and comment upon Edward III.'s claim to the French throne.

14. (*Boys.*) Write out Euclid I. 26.
Show that the middle point of the hypothenuse of a right-angled triangle is equidistant from the three angles.

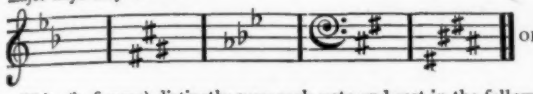
(*Girls.*) What are the advantages and disadvantages of the different methods of cooking?

15. In giving lessons on counting to very young children, say what apparatus you would find useful, and how you would make such lessons effective if you had no apparatus.

PUPIL TEACHERS' ROUTINE FOR MARCH, 1894.

DAYS	YEARS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	1	Analysis and Parsing	Battles of the Period	Maps of Wales and Scotland	Composition or Paraphrasing	How to teach Writing	Geography of Scotland	Analysis and Parsing	How to teach Arithmetic	Maps of England and Ireland	Composition or Paraphrasing	Revise Dates	Geography of Australia
	2			Maps of France and Italy		Notes of an Arithmetic Lesson	Latitude and Longitude		Notes of a Lesson on Form	Map of Spain. Map of Coast from Gibraltar to Venice.			Geography of Europe
	3			Map of India			Geography of Asia or Africa			Map of Mediterranean Sea			Geography of Africa
TUESDAY	1	Euclid I., 1 to 4. Definitions, etc. Paper Patterns	Abstract Vulgar Fractions. Practice	Lives of Great Historic Persons	Euclid I. Deductions. Paper Patterns	Vulgar Fractions of Money. Bills of Parcels	Lives of Great Historic Persons	Euclid I., 5 to 13. Practise Stitches	Vul. Fractions of Weights and Meas. Add. of Vul. Frac.	Science or Scripture	Euclid I. Deductions. Practise Stitches	Brackets in Algebra. Any Geography	Needlework or School Management
	2	Euclid I., 1 to 15. Paper Patterns	Simple Proportion Money. Vulgar Fractions		Euclid I. Deductions. Flannel Patch	Stocks. Vulgar Fractions of Weights		Euclid I., 16 to 26. Practise Stitches	Percentages. Reductions of Vulgar Fractions		Euclid I. Deductions. Practise Stitches	Algebraic Factors. Any Geography	
	3	Euclid I., 1 to 27. Paper Patterns	Comp. Proportion. Any Vulgar Fractions		Euclid I. Deduction. Practise Stitches	Equation of Payments. Decimals of Money		Euclid I., 27 to 48. Any Needlework	Discount. Decimals of Measures		Euclid I. Deductions. Any Needlework	Simple Equations. Any Geography	
WEDNESDAY	1	History from 55 B.C. to 410 A.D.	Composition or Paraphrasing	Science or Scripture	History from 410 to 871 A.D.	Grammar from Text-Book	Science or Scripture	History from 871 to 1016 A.D.	Prefixes, Roots, or Affixes	Needlework or School Management	History from 1016 to 1066 A.D.	Grammar from Text-Book	Science or Scripture
	2	History from 1066 to 1135 A.D.			History from 1135 to 1215 A.D.			History from 1307 to 1376 A.D.			History from 1422 to 1485 A.D.		
	3	History from 1485 to 1547 A.D.			History from 1547 to 1588 A.D.			History from 1628 to 1649 A.D.			History from 1666 to 1688 A.D.		
THURSDAY	1	Geography of England	Addition of Algebra or Any Arithmetic	Literature or Lives of Authors	Geography of Ireland	Subtraction of Algebra. Any Dates	Dates	Geography of British North America.	Multiplication of Algebra or Any Grammar	Dates	Physical Geog. of Mountains and Rivers	Literature or Lives of Authors	Division of Algebra. Any Dates
	2	Geography of Europe	Addition of Algebra or Any Arithmetic		Geography of India	Subtraction of Algebra. Any Dates	History from 1215 to 1307 A.D.	Geography of India	Multiplication of Algebra. Any Grammar	History from 1376 to 1422 A.D.	Climates and Productions of our Empire		Division of Algebra. Any Dates
	3	Geography of Asia	Simple Equations. Any Arithmetic		Geography of Africa	G.C.M. of Algebra. Any Dates	History from 1588 to 1628 A.D.	Geography of Asia	Mensuration of Triangle or Any Grammar	History from 1649 to 1666 A.D.	Winds and Ocean Currents		Mensuration of Parallelograms. Any Dates
FRIDAY	1	Abstract Decimals. Household Accounts	Test Examination (See appended Questions)		Decimal Fractions of Money. Practice	Test Examination (See appended Questions)		Dec. Fractions of Weights and Meas. Subt. of Vul. Fracs.	Test Examination (See appended Questions)		Reduction of Fractions. Bills of Parcels	Test Examination (See appended Questions)	
	2	Comp. Proportion. Reduction of Vulgar Fractions.			Averages. Vulgar Fractions of Measures			Stocks. Vul. Fractions of Weights and Meas.			Any Problems. Simple and Compound Practice		
	3	Stocks. Simple Proportion			Square Root. Repeating Decimals			Stocks. Decimals of Weights			Discount. Simple Proportion		
SATURDAY	1	French or Latin	Grammar from Text-Book.	Theory of Music	French or Latin	Singing	French or Latin	Proofs and Illustration of Arithmetical Rules	Drawing or Writing	Theory of Music	French or Latin	Lines of Latitude and Longitude of the required Maps	Singing
	2				Exercises only of Euclid or any Sewing	Drawing or Needlework			Drawing or Writing		Drawing or Needlework		
	3												

16. Re-write the following signatures, placing the sharps and flats in their customary order and position, and state for what major keys they stand :—



OR

Write (in figures) distinctly over each note and rest in the following passage its value in pulses, or fractions of a pulse :—

| n :- .s :f .,l | s :— : | .s :d : ‖

17. Decline *pater, filius, domus.* Write down the genitive plural of *avis.* Compare *gracilis, sacer, plus, ulterior, grate ;* or

Write down the feminines of the following adjectives :—*complet, bref, long, doux, loyal, expres.*

THIRD YEAR.

1. (*Boys.*) (*a*) Divide 30 tons into 3 parts in the proportions of 3·2, 3·15, and 3·25.
Ans. 10 Tons; 9 tons 16 cwt. 3qrs. 14lbs. ; 10 tons 3 cwt. 0qrs. 14lbs.

(*b*) Prove that a fraction is divided by a whole number when its numerator is multiplied by that number.

(*Girls.*) (*a*) Divide the product of ·000015625 and 120 by the difference of ·5817 and ·4892. Ans. ·02627.

(*b*) As in Boys.

2. (*Boys.*) In a room 25 feet square, a carpet 21½ feet square was laid down, leaving an even margin. This margin was covered by an oil-cloth which also reached 6 inches underneath the carpet all round. The oil-cloth cost 3s. 0d. per square yard, and the carpet 6s. 0d. per square yard. What was the whole cost?
Ans. £18 16s. 5d.

(*Girls.*) A man leaves to two of his daughters $\frac{1}{3}$ and $\frac{3}{11}$ of his property respectively, and the remainder to a third. The first had for her share £12·507; what would the third have?
Ans. £11,142 12s. 0d.

3. In a certain examination, every candidate was allowed to take either the Language Paper or the Science Paper, or both; 75·6 per cent. took the Language Paper; 87·4 per cent. took the Science Paper, and there were 1,700 candidates. How many took both papers?
Ans. 1,071.

4. As in First Year.

5. Paraphrase—

'We *spoke* not, *rapt* in nameless reverie,
Perchance upon the future man: the *walls*
Blackened about us, bats wheeled, and owls whooped,
And *gradually* the powers of the night,
That range above the region of the wind,
Deepening the courts of twilight, broke them *up*
Through *all* the silent spaces of the worlds
Beyond all thoughts into the Heaven of Heavens.'

6. Analyse the above passage and parse the words in italics.

7. Give examples of adjectives used factitively, interjections governing a noun sentence, *that* introducing an adverbial sentence, and nouns used to modify.

8. Draw a map of the eastern half of the Mediterranean Sea.

9. What do you know of *The Japanese Current, The Gulf Stream, The Sirocco,* and *The Anti-Trades?*

10. Describe the course of the Nile or the Yang-tse-kiang.

11. What do you know of the Courts of Star Chamber and High Commission?

12. What improvements in manufactures took place in Elizabeth's reign? How did they come about?

13. Describe Elizabeth's duel with Spain.

14. (*Boys.*) Write out Euclid I. 48.
The line joining the bisectors of two exterior angles of a triangle with the opposite interior angle bisects that angle.

(*Girls.*) Write out twelve rules, the observation of which will tend to the preservation of health.

15. Show, by means of illustrations, how you would explain to a class of scholars the reason of one of these processes:—

(*a*) Finding the common denominator of three or more fractions.

(*b*) Reducing miles to half-inches.

16. Write in the Treble Clef the signature and ascending scale of G minor, (*a*) using the minor sixth and major seventh, and (*b*) using the major sixth and major seventh; OR

Name the following intervals :—

| se / d | se / f | d' / se | f / se, ‖

17. Give the principal parts of *findo, negligo, mixeo, mulgeo;* also the infin. and the 1st pers. sing. pres. indic. of *ratus sum, genuisti, trivere, confessus est;* OR

Give the present and past participles and the 1st pers. sing. of the pres. indic. of *courir, venir, savoir, battre, connaitre, coudre, moudre,* and *taire.*

(*For Correspondence, see end of Certificate Article.*)

TEACHING NOTES ON 'THE LIFE AND DUTIES OF THE CITIZEN.'

By the authors of 'Hughes's Constitutional Reader : a Series of Lessons on the Life and Duties of the Citizen.' (Published by Joseph Hughes & Co., Froebel House, St. Andrew's Hill, Doctors' Commons, E.C.)

LESSON XII.—PUBLIC DEPARTMENT.

I. Introduction.

Work of Government threefold—legislative, judicial, executive; first two already dealt with. Executive, or means by which laws carried out, vested in public departments of which there are about fourteen. Member of the Government (generally a Cabinet Minister) is at the head of each department, assisted by a permanent staff of civil servants.

II. The Treasury.

1. *Composition.*—Treasury Board consists of First Lord of the Treasury (generally the Prime Minister), Chancellor of the Exchequer, and three or four junior Lords of the Treasury; but Chancellor of the Exchequer is practically at the head.

2. *Work.*—To provide, by means of taxation, funds for the different public departments to carry on their work. The estimates (prospective) drawn up each year at beginning of April, and means by which money to be raised stated in House of Commons by Chancellor of the Exchequer in his Budget Speech. These means must be approved by Commons, which, for this purpose, forms itself into a Committee of Supply.

3. *Taxes.*—Money paid by people for support of Central Government. Chief taxes—customs, excise, stamp duties, land tax, inhabited house duty, property and income tax.

(*a*) *Direct taxes.*—All above except first two. So called because money paid *directly* in the form of a tax by individuals concerned.

(1) *Stamp duties* on legacies, agreements, etc.

(2) *Land tax and property tax* paid on land and property.

(3) *Income tax* on all incomes of £150 and upwards.

(4) *Inhabited house duty* on all houses rented above £20.

(*b*) *Indirect taxes* (Customs and Excise). Tax paid by people indirectly in the form of increased price of goods owing to the imposition of these duties.

(1) *Customs* duties—now confined to so-called articles of luxury (spirits, wines, tobacco, cigars, tea, dried fruit, etc.) imported.

(2) *Excise duties* on beer and spirits produced in this country; also in form of licenses for sale of alcohol, tobacco, etc., for keeping men-servants, dogs, etc.

III. Education Department.

1. *Composition.*—Committee of Privy Council at whose head Lord President assisted by Vice-President. Work practically performed by latter official.

2. *Duties.*

(*a*) Elementary Schools (day and continuation) inspected by duly appointed officials, and grants paid for their support.

(*b*) Provision and examination of teachers (pupil teachers, students resident in day or residential colleges, acting teachers).

(*c*) Supervision and direction of Elementary Education generally. Work of schools regulated by document issued by Education Department each year called 'The Code.'

2. *Science and Art Department* under control of President and Vice-President for encouragement of teaching of science and art. Grants paid annually for this purpose.

IV. Local Government Board.

1. *Composition.*—Board consists nominally of a number of Cabinet Ministers, at head of which is a President who practically controls the Board.

2. *Duties.*

(*a*) General supervision of work of all local boards. Inspectors and auditors appointed.

(*b*) Administration upon questions affecting public health.

(*c*) Supervision and examination of workhouse schools.

V. Board of Trade.

1. *Composition.*—Nominal Board, as in last case, at head of which President.

2. *Duties.*—All questions affecting carrying on of trade, such as supervising railway system, weights and measures, lighthouses, harbours, piers, signals, lifeboats. Two important departments—bankruptcy and labour.

(*a*) *Bankruptcy department* deals with cases of insolvent traders and investigates cases of insolvency. Fraudulent bankruptcy is an indictable offence.

(*b*) *Labour department* deals with questions affecting labour market; information upon condition of trade and business in different parts of country published in 'Labour Gazette' for use of workmen.

VI. Board of Agriculture.

Only recently constituted. A nominal Board with President at head.

Duties.

(1) Deals with infectious diseases among cattle, prohibiting, when necessary, the importation or removal of cattle.

(2) Administers upon certain questions affecting the tenure of land.

(3) Endeavours to improve condition of agriculture generally by promoting intelligent and scientific methods of farming, and providing instruction in the management of dairies.

VII. The Post Office.

Controlled by Postmaster-General. A Government monopoly.

Duties.

(1) Conveying letters and parcels from place to place. Express letter service a recent addition.

(2) Control of telegraph and public telephone systems.

(3) Issuing of money orders (postal orders and Post Office orders), receiving deposits in Savings Bank, effecting life insurances and annuities. (This might with advantage be made a special lesson for inculcating habits of thrift and explaining the system generally.)

Read 'C.R.,' Chapters 18–24.

LESSON XIII.

I. The Secretaries of State.

Next five departments presided over by Her Majesty's Chief Secretaries of State for the Home Department, Foreign Department, India Office, Colonial Office, and War Office.

1. *The Home Office*, dealing with home affairs. Ordinary means of communication between Sovereign and people.

Duties.

(1) *Factories.*—Hours of labour of women and children in factories regulated and healthy condition of buildings secured.

(2) *Mines.*—Conditions of labour in mines supervised and accidents enquired into.

(3) *Prisons.*—General control of prisons and of reformatory and industrial schools. Metropolitan police under control of Home Office. It is also, in name of Sovereign, the final court of criminal appeal.

2. *Foreign Office.*—Very important; requiring at its head a man of great tact and decision.

Duties.

(1) To maintain friendly relations with all foreign powers and to secure just treatment of Englishmen abroad. Ambassadors appointed to represent England in principal foreign courts, Consuls in foreign ports for protection of British trade.

(2) To effect treaties (commercial and otherwise) with other nations.

(3) To introduce foreign ambassadors to English court and to consult them from time to time on matters of importance affecting the countries they represent.

3. *India Office*, controlling affairs of India generally.

Constitution.—Secretary, assisted by Council well acquainted with Indian affairs. Viceroy, resident in India, aided by a Council resident in the country, some of whom are native Indians appointed by Sovereign. All acts of executive government in India subject to approval of home government through the India Office.

4. *Colonial Office* manages all affairs of State between mother-country and colonies. In most important colonies Governors and Governors-General appointed, resident in country while in office. All laws passed by colonial legislatures (where they exist) subject to approval of this office.

5. *War Office* to provide and equip army for defensive and offensive purposes when necessary.

(1) *Constitution.*—Secretary, assisted by Commander-in-Chief of the army, appointed by Sovereign; and Under-Secretary, and a Financial Secretary.

(2) *The Army.*—Two branches — Regular Army and Auxiliary Forces.

(*a*) *Regular Army.*

(α) *Cavalry regiments.*—Life Guards, Horse Guards, Dragoons, Hussars, Lancers, and Horse Artillery.

(β) *Infantry.*—Royal Engineers, Grenadier, Coldstream, and Scots Guards, Marines, and regiments of the line.

By short service system, each man joins in first place for twelve years—first seven served in regular army, other five either in army reserve or regular army; after this, he may rejoin for another nine years, making a total of twenty-one years.

(*b*) *Auxiliary forces.*

(α) *Army reserve* consists of those just mentioned and volunteers from the Militia. They go into training for about eight days in each year, and are liable, in case of war, to be called upon to serve in the regular army.

(β) *Militia.*—Men who voluntarily submit to about a month's training in every year.

(γ) *Yeomanry.*—Volunteer horse-soldiers who undergo about fourteen days' training each year.

(δ) *Volunteers.*—Artillery and Rifle; former using larger kind of gun, latter ordinary rifles. They serve in local corps and are subject to annual inspection. Used for home defence only.

(*c*) *Army districts.* — The whole country is divided into ten districts, each in charge of a general officer, who has superintendence of both regulars and auxiliaries in his district.

Officers in the army are of two kinds—commissioned and non-commissioned; the latter just above the ranks, the former hold a commission from the Sovereign after examination.

II. The Admiralty Board consists of First Lord assisted by other Lords of the Admiralty—men experienced in naval affairs—also Civil Lord of the Admiralty. Its duty is to provide and equip ships and men to serve in the Navy.

1. *The Navy.*—Two branches—Regular Navy and auxiliary forces.

(*a*) *Auxiliaries.*

(α) *Royal Naval Reserve*, made up of men belonging to merchant service. They submit to twenty-eight days' drill in each year and assist regular navy in emergency.

(β) *Coastguardsmen* stationed at different points round coast to prevent smuggling, report ships in danger and foreign war-ships, to save life at sea, to protect wrecked property, and to instruct naval reserve.

2. *The Army and Navy.*—Position of men one of great responsibility, and duties need exercise of strict obedience, coolness and self-control in time of danger, and great courage. (A few examples from English History may be given by teacher.)

Existence of large and efficient army and navy are the best guarantee of peace. Wherever possible, arbitration should take place of war, which brings countless evils in its train. (Behring Sea Fisheries dispute settled by arbitration in 1893.)

III. The Scotch Office.

Recently added (1885); presided over by Secretary for Scotland. Deals exclusively with matters relating to Scotland, and has charge of the education of that country.

IV. The Irish Office.

Lord Lieutenant and Secretary to Lord Lieutenant, both having residences in Dublin, assisted by Irish Privy Council. They manage the whole government of that country, subject only to Cabinet at home.

Read 'C.R.,' Chapters 25–28.

LESSON XIV.

I. Voting.

a. The exercise of the vote is a right and a duty. The vote should be—

(1) *honest* — expressing true opinion of elector; (2) *intelligent*—expressing an opinion formed after due deliberation; (3) *definite*—expressing a distinct desire.

b. Information may be obtained by (1) public meetings, (2) reading, (3) discussion.

II. Paying Rates and Taxes.

Rates for local purposes vary in different districts; taxes for Imperial purposes are same all over the country.

a. What we pay for.

(1) Protection of life and property.

(2) Sanitation, paving, drainage, etc.

(3) Education and all other advantages of a civilised community.

b. Guarantees of money being well and wisely spent.

(1) Local Government Board Auditors examine local accounts.

(2) Nation's yearly balance sheet (Budget) presented to Parliament.

(3) The spenders (representatives) elected by the people.

III. Maintenance of Health.

a. Importance to community.—Good health enables each individual to put forth his best endeavours, and thus secures happiness and contentment of himself and his fellow citizens.

b. Aids to health.

(1) *Personal.*

(α) Cleanliness in house and person.

(β) Plentiful provision of fresh air (ventilation).

(γ) Temperance in eating, drinking, work, etc.

(2) *Public.*

(α) Provision of open spaces and recreation grounds, which should be carefully preserved and protected by the people.

(β) Isolation of infectious diseases by means of fever hospitals, etc.

(γ) Purity and plenitude of water supply.

IV. Education.

a. Importance to community.—Education tends to make a man thoughtful, intelligent, and self-reliant, and renders him better fitted to perform civic duties. It also has great moral influence.

b. Duties of parents.

(1) To enforce regularity of attendance.

(2) To work sympathetically with teachers in training children in habits of observation, good conduct, and carefulness.

(3) To occasionally test the progress of the child and thus encourage perseverance.

(4) To allow the child's attendance at school to be continued as long as possible. Much harm is done by taking children away at earliest possible time.

c. Duties of Scholars.

(1) To take every advantage of opportunities offered and not to fritter away time heedlessly. By means of scholarships tenable at higher schools, many have risen from elementary schools to Universities, and are now holding positions of great responsibility.

(2) To cultivate a love for the acquisition of knowledge, which is sure to be of great value after leaving school.

(3) To continue education after leaving day-school by attending evening continuation schools, science and art classes, technical classes, etc.

Remember.—School and College are only the beginning of a citizen's education.

Read 'C.R.,' Chapters 30–33.

LESSON XV.

I. Provision for the Poor.

a. Causes of pauperism.

(1) *Unavoidable.*—Misfortune in business; continued sickness.

(2) *Avoidable.*—Lazy disposition, reckless expenditure, want of forethought, habits of vice and drunkenness, open and continued crime.

b. Diminution of Pauperism.

(1) Provision by careful saving against old age and sickness by means of friendly societies, insurance societies, and government annuities in connection with Post Office. Stability of society should be duly enquired into. Such habits of providence should be inculcated from very earliest years. (Banks in schools.)

(2) Realising importance of self-dependence and degradation attaching to dependence upon others.

II. Order and Respect for Law.

a. Its importance.

For happiness and well-being of community, absolutely necessary that each person's home, property, reputation, and character should be protected—hence need of laws. But besides written law, everyone should recognise an unwritten code of laws guiding him in his actions towards his fellow men. Much may be done by example of peaceable behaviour on the part of citizens. Fraud in all relations of life should be discouraged.

b. Instances of laws which must be obeyed.

(1) Registration of births, marriages, and deaths. (To prevent concealment in matters which so vitally affect the morality and well-being of the nation.)

(2) Notification of infectious diseases. (To check, as far as possible, the spread of disease.)

(3) Prevention of cruelty to children and animals. (To protect those incapable of helping themselves.)

III. Public Spirit and Public Opinion.

a. Meaning.—Public spirit measured by interest taken in questions affecting the community generally; public opinion by general standard of comfort, happiness, and duty aimed at by community. Public opinion should be honest and intelligent, and should be expressed in an unequivocal manner.

b. How expressed.

(1) *By public meetings.*

(α) *Their conduct.*—Public meetings should be conducted in a spirit of order and fair-play. The ruling of the chairman should be rigidly obeyed. In properly conducted meetings the opinions of each side allowed to be expressed.

(β) *Their uses.* — (i) To express public opinion; (ii) to educate and instruct; (iii) to exercise watchfulness over public bodies.

(2) *By public press.*—One of the most important factors of the present day. Its uses same as those of public meetings mentioned above.

c. Effect of healthy public opinion and good public spirit.

(1) Active co-operation of all in the system of government.

(2) Selection of most capable citizens to serve on public bodies.

(3) Benefit of whole community.

Read 'C.R.,' Chapters 34–36.

THE 1894 SCHOLARSHIP EXAMINATION.

BY DR. GEORGE BEACH, M.A.,

Co-Author of 'A Manual of our Mother Tongue,' 'A Girl Arithmetic.' Author of 'Elements of English,' 'Entertaining Readers,' 'Historical Readers,' etc.

I. The following answer has been received by the Examination Editor :—

'*Queen's Scholarship Examination.*

'Education Department,
'Whitehall, London, S.W.

'SIR,—In reply to your letter of the 12th instant, I am directed to inform you that the words added to note "‖" at the foot of Schedule V. of the Code were not intended to apply to examinations in Drawing, but only to examinations in Science.

'It is intended to make this clear in next year's Code, and also to alter the provision as to science examinations, by allowing them to count if passed within *two* years of the Queen's Scholarship Examination.

'I have the honour to be, Sir,
'Your obedient servant,
'G. W. KEKEWICH.

'George Beach, Esq., M.A., LL.D.'

"‖" The note referred to runs :—'After the present year marks will not be given at any examination for a pass at any examination held more than a year previously.' Whilst fully acknowledging the

courtesy of the Department in replying, and cordially appreciating the very considerable concessions involved in withdrawing Drawing from the operation of this restrictive regulation, and in extending the qualifying period to *two* years, nevertheless, from an educational point of view, the rule should be protested against.

Though the evil is minimised the principle still remains.

It is well known that the work for 1st and 2nd year pupil-teachers is not in some subjects so advanced as for Standard VII. candidates. These, then, are the years wherein a pupil-teacher should pass his elementary and advanced scholarship science, the boys taking (say) physiography, and the girls (say) hygiene.

How much more intelligent then would be their study of geography and domestic economy.

As it is, the young pupil-teacher is tacitly encouraged to rest upon his oars for the first two years of his apprenticeship, and to cram during the last two.

Further, a great injustice will be inflicted upon many teachers who have to sit for 'scholarship' a second or third time.

Supposing a case (and we know several such personally) where a scholarship candidate has obtained his science certificate two years before his scholarship examination. He is successful in securing a first-class scholarship, but having attempted to enter a metropolitan training college is yet too low to be admitted, and applies to provincial colleges too late.

Perforce, he sits the scholarship examination again in the following year, but *mirabile dictu*, his science will not now count, through no fault of his own, but owing to deficiency in training college accommodation. The least that should be done is to enact that '*Any marks for extra subjects that have been counted at any scholarship examination successfully passed, shall be allowed at any subsequent scholarship examination.*' But, most decidedly, we prefer the elision of the offending provision.

II. Recent Geographical Information.

(*a*) *Sealing in the Behring Sea.*—It is notified in the *London Gazette* that under the Seal Fishery (North Pacific) Act, 1893, an arrangement has been made between her Majesty the Queen and his Imperial Majesty the Emperor of Russia, whereby British ships engaged in hunting seals within certain parts of the seas may be seized by Russian cruisers. The following order has now been promulgated by her Majesty in Council:—'From and after the date of the present order until her Majesty in Council should otherwise direct, the catching of seals by British ships is hereby prohibited within such parts of the seas to which the Act applies as are comprised in the following zones, that is to say, a zone of ten marine miles on all the Russian coasts of the Behring Sea and the North Pacific Ocean, and a zone of 30 marine miles round the Kormandorsky Islands and Tulenew (Robben Island). The powers which under the Act may be exercised by any commissioned officer on full pay in the Naval service of her Majesty may be exercised by the captain or other officer in command of any war vessel of his Imperial Majesty the Emperor of Russia, in relation to a British ship and the equipment and crew and certificate thereof.'

(*b*) Professor Boyd Dawkins recently delivered a lecture at Owens College, Manchester, on '*The South-Eastern Coal-field at Dover.*' He stated that by boring at the Shakespeare Cliff, Dover, twelve seams of coal had been struck, the first at a depth of 1,136 feet below high-water mark, the second 64 feet lower down, whilst the twelfth occurred at a depth of 2,177 feet.

The first seam was 2 ft. 6 ins. thick, the second 1 ft. 2 ins., the third 2 ft. 6 ins., but the last 4 ft.

There could be no doubt that these seams proved the existence of a large, important, and valuable coal-field in the south-east of England, which stretched also under the English Channel.

The result would be that within the next few years a large and important coal-field would be opened out, and the industries of that part of England would be revived.

(*c*) *Africa between Lake Tanganyika and the Zambesi Mouth.*—Evidences of British administration are first seen at Chinde, on the sea coast, where is a Vice-Consulate, situated on a concession of land from the Portuguese. Moving up the Zambesi and Shiré River we come to Tchirome, the frontier station separated from Portuguese territory by the River Ruo. Land here is 2s. 6d. per acre, the postal service is rapid, and the telegraph is being instituted.

Hence a good road leads to the Shiré Highlands, whose coffee, tobacco, and oranges, are already in the market, and where the rush of business at the African Lakes Company's premises is of a European character. From Blantyre well-made roads extend for 30 or 40 miles in all directions, and probably this neighbourhood will soon contain the principal city of British Central Africa, as it is in every way fitted for European civilisation, and is on the old slave route to Quilimane.

Much of the country is now organised; births, deaths, and marriages are registered; and a land court is in active operation.

Three forts command the Upper Shiré, and four gunboats traverse its entire length. In North Nyassa is a strong station of the African Lakes Company, which forms the trade base for the Tanganyika plateau.

Ascending this table-land, and pushing due west, we possess about 200 miles in length of splendid pasture and wheat-growing country, sufficient to meet any home emergency.

Trading and mission stations are dotted about right up to South Tanganyika, where they join hands with those of Ujiji.

Thus we have an unbroken line of activity from the Indian Ocean to Lake Tanganyika.

III. Notes on Simple Proportion.

(*a*) '*If* 21 *pigs cost* £35, *what will* 15 *pigs cost?*'

Ans. £25.

All proportion consists of at least four terms. In problems on proportion any three of these must be given to find the fourth. Hence the term '*Rule of Three.*' The four terms will arrange themselves into two couples. Each member of the couple must be of the same kind, and as a rule each couple will be of different kinds.

In the example above, the first couple is *pigs* and *pigs*, and in the second couple *money* and *money*.

Even when all four terms seem of the same kind, as in '*If* £21 *gain* £35, *how much will* £15 *gain?*' *Ans.* £25, a little investigation will show that the couples are of different kinds. For, although all are money, yet the two terms of the second couple indicate '*money gained.*'

(*b*) Proportion consists in the equality of ratios, and no ratio can exist except between magnitudes of the same kind. Hence the members of each couple must be of the same kind.

Proportion can with advantage be represented by vulgar fractions.

Thus $\frac{21 \text{ pigs}}{15 \text{ pigs}} = \frac{£35}{£25}$, or cancelling the pigs and pounds from the numerators and denominators $\frac{21}{15} = \frac{35}{25}$.

This is evident, as each equals $\frac{7}{5}$.

(*c*) Employing fractions we can easily prove the fundamental property of proportion,—'*The product of the extremes is equal to the product of the means.*' The first and fourth terms are called *the extremes;* the second and third terms the *means.* We will employ letters to demonstrate this, as even our readers who are innocent of any suspicion of Algebra will be able to follow the process.

Required to prove that if $n : m$ as $p : q$, then $p \times m$ shall $= q \times n$. $\frac{n}{m} = \frac{p}{q}$. Now, whatever multiple, integral or fractional, p is of n, also q is of m. Let $p = o \times n$, then also $q = o \times m$.

Now $o \times n \times m = o \times n \times m$.

But $p = o \times n$;

$\therefore p \times m = o \times n \times m$.

Also $q = o \times m$;

$\therefore p \times m = q \times n$. Q. E. D.

(*d*) Reverting to our problem, we will deduce the ordinary rule, viz., '*Multiply the second and third terms together, and divide by the first,*' the answer being of course the fourth term.

We have shown that

1st term × 4th term = 2nd term × 3rd term.

Divide both sides of this equation by 1st term.

Then 4th term = 2nd term × 3rd term ÷ 1st term.

Q. E. D.

In the example £35 × 15 pigs = 21 pigs × £x.

$\therefore$ £35 × 15 = 21 × £x.

$\therefore \frac{£35 \times 15}{21} = £x$.

$\therefore$ £25 = £x. Q. E. D.

(*e*) *Given the 1st, 2nd, and 4th terms, to find the 3rd.*

$$2\text{nd} \times 3\text{rd} = 1\text{st} \times 4\text{th};$$
$$\therefore \quad 3\text{rd} = 1\text{st} \times 4\text{th} \div 2\text{nd}.$$

Rule.—Multiply the 1st and 4th terms together, and divide by the 2nd.

(*f*) *Given the 1st, 3rd, and 4th terms, to find the 2nd.*

$$2\text{nd} \times 3\text{rd} = 1\text{st} \times 4\text{th};$$
$$\therefore \quad 2\text{nd} = 1\text{st} \times 4\text{th} \div 3\text{rd}.$$

Rule.—Multiply the 1st and 4th terms together, and divide by the 3rd.

(*g*) *Given the 2nd, 3rd, and 4th terms, to find the 1st.*

$$1\text{st} \times 4\text{th} = 2\text{nd} \times 3\text{rd},$$
$$\therefore \quad 1\text{st} = 2\text{nd} \times 3\text{rd} \div 4\text{th}.$$

Rule.—Multiply the 2nd and 3rd terms together, and divide by the 4th.

(*h*) These *four* rules can be reduced to two.

(i) To find an extreme,—Multiply the means together and divide by the given extreme.

(ii) To find a mean,—Multiply the extremes together and divide by the given mean.

(*i*) In every problem on Simple Proportion there are two parts,—something given (*the data*), and something required (*the quæsita*). '21 pigs cost £35' is the *data;* what will 15 pigs cost?' is the *quæsita.*

It matters not which of these parts is first given. 'What will 15 pigs cost, if 21 pigs cost £35?' is just as good a form as the other.

(*j*) *The data* always contains two terms, the *quæsita* contains one term, but asks for the other.

As 1st : 2nd :: 3rd : 4th; ∴ the 4th term is of the same kind as the 3rd, and generally of a different kind from the 1st and 2nd. Hence the 3rd term is loosely called the *odd term.*

(*k*) The following proportions should be proved as exercises, eliminating denominations, and dealing with members only.

(i) As 2nd : 1st :: 4th : 3rd.
(ii) As 1st : 3rd :: 2nd : 4th.
(iii) As 3rd : 1st :: 4th : 2nd.
(iv) As 1st + 2nd : 2nd :: 3rd + 4th : 4th.
(v) As 1st − 2nd : 1st + 2nd :: 3rd − 4th : 3rd + 4th, &c.

(*l*) There are always four kindred problems in proportion, because each one of the terms may be sought whilst the remaining three are given; *e.g.*,

(i) If 21 pigs cost £35, what will 15 pigs cost?
Ans. £25.

(ii) If 15 pigs cost £25, what will 21 pigs cost?
Ans. £35.

(iii) If £25 buys 15 pigs, how many will £35 buy?
Ans. 21 pigs.

(iv) If £35 buys 21 pigs, how many will £25 buy?
Ans. 15 pigs.

(*m*) There are two kinds of proportion,—*direct* and *inverse.*

In stating a proportion sum we first select the 3rd term, which is known by its kinship to the required answer.

Then we enquire whether the answer must be more or less than the 3rd term; if more, we take the larger of the two remaining terms for the 2nd term; if less, the smaller.

The reason is obvious; for if we require more we must multiply the 3rd term by a greater number than we divide by.

In *direct proportion* the second term is always in the quæsita.

In *inverse proportion* the second term is always in the data.

Problems in inverse proportion are often connected with *time;* for as regards labour, 'the *more* men the *less* time' is the principle, *e.g.*,

'*If 21 men can do a piece of work in 25 days, how long will it take 15 men to do it?*' Ans. 35 days.

Another popular kind of inverse problem is,—

'When wheat is 21s. per bag the 2d. loaf weighs 25 ozs., what will it weigh when wheat is 15s. per bag?'

Ans. 35 ozs.

In *direct proportion:* As one term in the data is to the term (of the same kind) in the quæsita, so is the remaining term in the data to the answer.

In *inverse proportion:* As one term in the data is to the term (of the same kind) in the quæsita, so is the answer to the remaining term in the data.

(*n*) Cancelling can only take place between the first and second, and the first and third terms, but not between the second and third. This is evident if the process is thrown into the fractional form—

$$\frac{2\text{nd} \times 3\text{rd}}{1\text{st}} = 4\text{th}.$$

We may remove a common factor from the numerator and denominator, but not from two portions of the numerator. If we performed the latter operation the answer would be too little by the square of the factor removed.

IV.—A Few Questions in Religious Knowledge.

1. What is the leading thought in—
(*a*) The Covenant with Noah.
(*b*) The Covenant with Abraham.
(*c*) The Covenant of Sinai.

2. Define exactly what you mean by Faith, and mention *briefly* incidents in the life of Abraham in which he stands out as a conspicuous example of Faith.

3. Mention briefly any events from Abraham to Moses inclusive, which prove that the prayer of a righteous man availeth much when he prays for others.

4. What forms of (*a*) Idolatry and (*b*) unauthorised worship of God are referred to in the Book of Judges, and in what connection? Where was the Sanctuary of God during the period of the Judges?

5. (*a*) Notice the chief places and persons visited by David during his persecution by Saul. (*b*) Describe the reception he met with, and mention his most trusty followers during that period.

6. (*a*) For what reasons did the people of Israel wish for a King? (*b*) Why did Samuel oppose their wish? (*c*) Describe the manner of the choosing of (i) Saul and (ii) David to be king.

V.—Memoria Technica.

Many students find it well nigh impossible to learn off by heart historical dates and geographical statistics.

For these the following scheme may be useful; it certainly does not greatly assist the preliminary process, but figures once attached to events or places by this method are NEVER forgotten, as they form part and parcel of the invented word, and as their very uncouthness assists their retention.

Numbers	1	2	3	4	5	6	7	8	9	0
Vowels	a	e	i	o	u	au	eu	oo	ou	y
Consonants	b	d	t	f	l	s	p	k	n	g

This table may be remembered thus:—

1 is represented by *a* the first vowel, or *b* the first consonant.
2 ,, *e* ,, second ,, ,, *d* from Latin *duo* = 2.
3 ,, *i* ,, third ,, ,, *t* ,, ,, *tres* = three.
4 ,, *o* ,, fourth ,, ,, *f* ,, four.
5 ,, *u* ,, fifth ,, ,, *l* from L. = fifty in Roman Numerals.
6 ,, *au* = 1 + 5 or by *s* from six.
7 ,, *eu* = 2 + 5 ,, *p* ,, L. septem = 7.
8 ,, *oo* = 4 + 4 ,, *k* ,, Greek okto = 8.
9 ,, *ou* = 4 + 5 ,, *n* ,, nine.
0 ,, *y* the last vowel, or by *g* from nought.

Our Readers can with facility compile the date table by—

(i) Taking the root part of the name of the place or event.

(ii) Neglecting the thousands in historical dates (no scholarship candidate will err a thousand years).

(iii) Affixing to the root letters denoting the figures. Either vowels or consonants may be used, but it is well to form words easily sounded, and, if possible, with something singular about them.

We proceed to give a few instances :—

55	First Roman Invasion	= Firromul.
54	Second ,, ,,	= Secromuf.
43	Third ,, ,,	= Thromof.
64	Christianity introduced	= Chriso.
78	Agricola Governor	= Agreuk.
120	Picts' Wall built	= Walady.
286	Carausius revolts	= Careks.
303	St. Alban martyred	= Albigi.
410	Honorarius evacuates Britain	= Honoby.
449	Invasion of Jutes	= Jutofou.
477	,, Saxons	= Saxopeu.
520	,, Angles	= Angudy.

VI. MISCELLANEOUS HINTS.

(*a*) Learn the Greek Alphabet. Ruskin, in his '*Sesame and Lilies*,' urges this point very strongly, even upon those who don't intend to proceed to the study of Greek.

Moreover, if the prefixes, affixes, and roots can be given in their native letters, marks must follow.

(*b*) In writing, discard dual forms of the letters, and let those you adopt be of one system. Cut adrift, also, all flourishes, peculiarities, the looped *f*, the Italian *t*, the Greek *e*, etc.

(*c*) Practise free-hand drawing of straight lines with pen. Rulers are not allowed at the examination ; and ruling with a black-lead is very tricky and risky, besides being apt to supply blots.

(*d*) Read up most recent facts about Siam, Central Africa, and Matabeleland, Behring Sea Fishery, Dahomey, Manchester Ship Canal, and Brazil.

(*e*) Know something about the author of your repetition, and the whole scope of the poem.

(*f*) Get three notes of lessons ready for the Inspector, when he examines your teaching. At this time also should *all* the notes of lessons prepared during the year be submitted to his ken.

(*g*) Endeavour, after a sufficient interval, to re-translate into Latin or French your rendering of 'De Bello Gallico' or 'La Jeune Sibérienne.'

(*h*) Look after the little points, such as commas in punctuation, underlining emphatic phrases, cancelling *neatly* in arithmetical processes, delineation of mountains in map-drawing, un-ambiguous contractions in parsing, etc.

(*For Correspondence, see end of Certificate Article.*)

SELECTED GOVERNMENT QUESTIONS.

FIRST WEEK.

1. Write in Large-hand the word '*Indefatigable.*'
,, ,, Small-hand '*The quick brown fox jumps over a lazy dog.*'

2. Analyse the following sentence :—

They parted ne'er to meet again,
But never either found another
To free the hollow heart from paining ;
They stood aloof, the scars remaining,
Like cliffs which had been rent asunder,—
A dreary sea now flows between ;
But neither heat, nor frost, nor thunder,
Shall wholly do away, I ween,
The marks of that which once hath been.

3. Draw an outline map, with lines of latitude and longitude, showing the course of the Danube and its chief tributaries. Indicate the watersheds which bound its basin, and name the river basins lying to the N. and W.

4. Describe the situation, and account for the name, of *Lombard Street, Regent Street, Chester, Cologne, St. Petersburg, Constantinople, Alexandria, Virginia, Pennsylvania, Adelaide.* Refer to *seven* of these names only.

5. Give dates, or approximate dates, and names for the following :—

(*a*) An Act for the union of England and Scotland.
(*b*) A Declaration suspending penal statutes against Romanists and Dissenters.
(*c*) The Statute authorising the burning of heretics.
(*d*) The defeat of the Spanish Armada.
(*e*) An Act preventing prisoners being kept long in gaol without trial.

6. Explain what is meant by the Star Chamber, Bill of Attainder, Ship Money, Act of Supremacy, Justices in Eyre, and Romescot.

7. Mention any twelve words, the spelling of which presents special difficulty to young learners ; and say by what sort of exercises you can best help such learners to spell them correctly.

8. Give a plan of the school-room, class-room, and playground of the school with which you are best acquainted. Give the dimensions also, and say for how many scholars accommodation is provided.

9. Explain the following terms :—*Syncopation, Allegretto, Legato, Diminuendo.*

10. If a person sells, for £18 each, fifty £10 shares in a company which pays a dividend of 8 per cent., and then invests the proceeds of this sale in the purchase of £5 shares in another company at £3 10s. each, find what difference is made in his income if the second company pays a dividend of 3½ per cent. Ans. £5.

11. Divide $2\frac{1}{4} - \frac{3}{8}$ of $1\frac{5}{6}$ by $\frac{1}{6}$ of $3\frac{1}{3} + \frac{7}{8}$, and reduce $4\frac{7}{8}\frac{5}{1}\frac{4}{7}$ to its lowest terms. Ans. $\frac{279}{288} : \frac{7}{6}$.

12. (*Men only.*) Write out Euclid I. 28.

From the vertex of an isosceles triangle a line is drawn to any point in the base. The square on a side of the triangle is equal to the square on the line so drawn, together with the rectangle contained by the segments of the base.

(*Women only.*) Enumerate the articles necessary for the proper cooking and saving of food in a labourer's cottage, with cost of each.

13. (*Men only.*) Solve

$$\frac{5x-9}{8} + \frac{7x-1}{10} = \frac{11x+17}{15} + 6. \quad \text{Ans. } 14\frac{9}{71}.$$

(*Women only.*) Say what you consider to be (*a*) the most wholesome, and (*b*) the cheapest method of using a shoulder of mutton for a cottage Sunday dinner, and give your reasons for your opinion.

14. (*Men only.*) The ages of two men are as 4 : 3 ; but 9 years ago they were as 3 : 2. Find their present ages.

Ans. 36 years ; 27 years.

(*Women only.*) State particulars, as to a young servant, respecting the best method by which to clean a hearthrug, a brass tap, an iron grate, a mahogany table, and a glass jug.

15. (*Men only.*) The arc of a sector of a circle is 55 ft., and the radius of the circle is 26¼ ft. Find the area of the sector.

Ans. 80 sq. yards 1⅞ ft.

(*Women only.*) Describe the way to herring-bone flannel, to make a button-hole, to run a tuck, and to set-in gathers.

16. Put into French :—

(*a*) She had one day just finished her washing at the river.
(*b*) Sometimes she would take her Bible.
(*c*) What art thou doing there ? Fear not.
(*d*) I hope you will have some share in it.

17. Give as many idiomatic expressions as you can containing *coup.*

SECOND WEEK.

1. If you see anything wrong in the following sentences, correct them, and give your reasons :—

(*a*) I never remember to have seen him before.
(*b*) They deserve to receive condign punishment.
(*c*) Please to send either a written or a verbal reply.
(*d*) I intended to have pointed this out yesterday.
(*e*) He hoped every one had enjoyed themselves.
(*f*) The climate is as good, or even better than that of Madeira.

2. Give some examples of words in which the following syllables are contained, and show in regard to each group what is the common element of meanings, and from what language each word is derived :—*phil, rect, dom, sent, tele, tract.*

3. Give notes of a lesson on (*a*) An Eclipse of the Moon ; OR (*b*) The Employment of Colonists in W. Australia.

4. Write a short description of 'The Dependencies of Holland.' Mention places named by Dutch navigators which are not now politically connected with Holland.

(*e*) *Given the 1st, 2nd, and 4th terms, to find the 3rd.*

$$2\text{nd} \times 3\text{rd} = 1\text{st} \times 4\text{th};$$
$$\therefore \quad 3\text{rd} = 1\text{st} \times 4\text{th} \div 2\text{nd}.$$

Rule.—Multiply the 1st and 4th terms together, and divide by the 2nd.

(*f*) *Given the 1st, 3rd, and 4th terms, to find the 2nd.*

$$2\text{nd} \times 3\text{rd} = 1\text{st} \times 4\text{th};$$
$$\therefore \quad 2\text{nd} = 1\text{st} \times 4\text{th} \div 3\text{rd}.$$

Rule.—Multiply the 1st and 4th terms together, and divide by the 3rd.

(*g*) *Given the 2nd, 3rd, and 4th terms, to find the 1st.*

$$1\text{st} \times 4\text{th} = 2\text{nd} \times 3\text{rd},$$
$$\therefore \quad 1\text{st} = 2\text{nd} \times 3\text{rd} \div 4\text{th}. \quad ''$$

Rule.—Multiply the 2nd and 3rd terms together, and divide by the 4th.

(*h*) These *four* rules can be reduced to two.

(i) To find an extreme,—Multiply the means together and divide by the given extreme.

(ii) To find a mean,—Multiply the extremes together and divide by the given mean.

(*i*) In every problem on Simple Proportion there are two parts,—something given (*the data*), and something required (*the quæsita*). '21 pigs cost £35' is the *data;* what will 15 pigs cost?' is the *quæsita.*

It matters not which of these parts is first given. 'What will 15 pigs cost, if 21 pigs cost £35?' is just as good a form as the other.

(*j*) *The data* always contains two terms, the *quæsita* contains one term, but asks for the other.

As 1st : 2nd :: 3rd : 4th; ∴ the 4th term is of the same kind as the 3rd, and generally of a different kind from the 1st and 2nd. Hence the 3rd term is loosely called the *odd term.*

(*k*) The following proportions should be proved as exercises, eliminating denominations, and dealing with members only.

(i) As 2nd : 1st :: 4th : 3rd.
(ii) As 1st : 3rd :: 2nd : 4th.
(iii) As 3rd : 1st :: 4th : 2nd.
(iv) As 1st + 2nd : 2nd :: 3rd + 4th : 4th.
(v) As 1st — 2nd : 1st + 2nd :: 3rd — 4th : 3rd + 4th, &c.

(*l*) There are always four kindred problems in proportion, because each one of the terms may be sought whilst the remaining three are given; *e.g.*,

(i) If 21 pigs cost £35, what will 15 pigs cost?
Ans. £25.

(ii) If 15 pigs cost £25, what will 21 pigs cost?
Ans. £35.

(iii) If £25 buys 15 pigs, how many will £35 buy?
Ans. 21 pigs.

(iv) If £35 buys 21 pigs, how many will £25 buy?
Ans. 15 pigs.

(*m*) There are two kinds of proportion,—*direct* and *inverse.*

In stating a proportion sum we first select the 3rd term, which is known by its kinship to the required answer.

Then we enquire whether the answer must be more or less than the 3rd term; if more, we take the larger of the two remaining terms for the 2nd term; if less, the smaller.

The reason is obvious; for if we require more we must multiply the 3rd term by a greater number than we divide by.

In *direct proportion* the second term is always in the quæsita.

In *inverse proportion* the second term is always in the data.

Problems in inverse proportion are often connected with *time;* for as regards labour, 'the *more* men the *less* time' is the principle, *e.g.*,

'*If 21 men can do a piece of work in 25 days, how long will it take 15 men to do it?*' Ans. 35 days.

Another popular kind of inverse problem is,—

'When wheat is 21s. per bag the 2d. loaf weighs 25 ozs., what will it weigh when wheat is 15s. per bag?'

Ans. 35 ozs.

In *direct proportion:* As one term in the data is to the term (of the same kind) in the quæsita, so is the remaining term in the data to the answer.

In *inverse proportion:* As one term in the data is to the term (of the same kind) in the quæsita, so is the answer to the remaining term in the data.

(*n*) Cancelling can only take place between the first and second, and the first and third terms, but not between the second and third. This is evident if the process is thrown into the fractional form—

$$\frac{2\text{nd} \times 3\text{rd}}{1\text{st}} = 4\text{th}.$$

We may remove a common factor from the numerator and denominator, but not from two portions of the numerator. If we performed the latter operation the answer would be too little by the square of the factor removed.

IV.—A Few Questions in Religious Knowledge.

1. What is the leading thought in—
(*a*) The Covenant with Noah.
(*b*) The Covenant with Abraham.
(*c*) The Covenant of Sinai.

2. Define exactly what you mean by Faith, and mention *briefly* incidents in the life of Abraham in which he stands out as a conspicuous example of Faith.

3. Mention briefly any events from Abraham to Moses inclusive, which prove that the prayer of a righteous man availeth much when he prays for others.

4. What forms of (*a*) Idolatry and (*b*) unauthorised worship of God are referred to in the Book of Judges, and in what connection? Where was the Sanctuary of God during the period of the Judges?

5. (*a*) Notice the chief places and persons visited by David during his persecution by Saul. (*b*) Describe the reception he met with, and mention his most trusty followers during that period.

6. (*a*) For what reasons did the people of Israel wish for a King? (*b*) Why did Samuel oppose their wish? (*c*) Describe the manner of the choosing of (i) Saul and (ii) David to be king.

V.—Memoria Technica.

Many students find it well nigh impossible to learn off by heart historical dates and geographical statistics.

For these the following scheme may be useful; it certainly does not greatly assist the preliminary process, but figures once attached to events or places by this method are NEVER forgotten, as they form part and parcel of the invented word, and as their very uncouthness assists their retention.

Numbers	1	2	3	4	5	6	7	8	9	0
Vowels	a	e	i	o	u	au	eu	oo	ou	y
Consonants	b	d	t	f	l	s	p	k	n	g

This table may be remembered thus:—

1 is represented by *a* the first vowel, or *b* the first consonant.
2 ,, *e* ,, second ,, ,, *d* from Latin *duo* = 2.
3 ,, *i* ,, third ,, ,, *t* ,, ,, *tres* = three.
4 ,, *o* ,, fourth ,, ,, *f* ,, four.
5 ,, *u* ,, fifth ,, ,, *l* from L = fifty in Roman Numerals.
6 ,, *au* = 1 + 5 or by *s* from six.
7 ,, *eu* = 2 + 5 ,, *p* ,, L septem = 7.
8 ,, *oo* = 4 + 4 ,, *k* ,, Greek okto = 8.
9 ,, *ou* = 4 + 5 ,, *n* ,, nine.
0 ,, *y* the last vowel, or by *g* from nought.

Our Readers can with facility compile the date table by—

(i) Taking the root part of the name of the place or event.

(ii) Neglecting the thousands in historical dates (no scholarship candidate will err a thousand years).

(iii) Affixing to the root letters denoting the figures. Either vowels or consonants may be used, but it is well to form words easily sounded, and, if possible, with something singular about them.

We proceed to give a few instances :—

55	First Roman Invasion	= Firromul.
54	Second ,, ,,	= Secromuf.
43	Third ,, ,,	= Thromof.
64	Christianity introduced	= Chriso.
78	Agricola Governor	= Agreuk.
120	Picts' Wall built	= Walady.
286	Carausius revolts	= Careks.
303	St. Alban martyred	= Albigi.
410	Honorarius evacuates Britain	= Honoby.
449	Invasion of Jutes	= Jutofou.
477	,, Saxons	= Saxopeu.
520	,, Angles	= Angudy.

VI. MISCELLANEOUS HINTS.

(*a*) Learn the Greek Alphabet. Ruskin, in his '*Sesame and Lilies*,' urges this point very strongly, even upon those who don't intend to proceed to the study of Greek.

Moreover, if the prefixes, affixes, and roots can be given in their native letters, marks must follow.

(*b*) In writing, discard dual forms of the letters, and let those you adopt be of one system. Cut adrift, also, all flourishes, peculiarities, the looped *p*, the Italian *t*, the Greek *e*, etc.

(*c*) Practise free-hand drawing of straight lines with pen. Rulers are not allowed at the examination ; and ruling with a black-lead is very tricky and risky, besides being apt to supply blots.

(*d*) Read up most recent facts about Siam, Central Africa, and Matabeleland, Behring Sea Fishery, Dahomey, Manchester Ship Canal, and Brazil.

(*e*) Know something about the author of your repetition, and the whole scope of the poem.

(*f*) Get three notes of lessons ready for the Inspector, when he examines your teaching. At this time also should *all* the notes of lessons prepared during the year be submitted to his ken.

(*g*) Endeavour, after a sufficient interval, to re-translate into Latin or French your rendering of 'De Bello Gallico' or 'La Jeune Sibérienne.'

(*h*) Look after the little points, such as commas in punctuation, underlining emphatic phrases, cancelling *neatly* in arithmetical processes, delineation of mountains in map-drawing, un-ambiguous contractions in parsing, etc.

(*For Correspondence, see end of Certificate Article.*)

SELECTED GOVERNMENT QUESTIONS.

FIRST WEEK.

1. Write in Large-hand the word '*Indefatigable.*'
,, ,, Small-hand '*The quick brown fox jumps over a lazy dog.*'

2. Analyse the following sentence :—

They parted ne'er to meet again,
But never either found another
To free the hollow heart from paining ;
They stood aloof, the scars remaining,
Like cliffs which had been rent asunder,—
A dreary sea now flows between ;
But neither heat, nor frost, nor thunder,
Shall wholly do away, I ween,
The marks of that which once hath been.

3. Draw an outline map, with lines of latitude and longitude, showing the course of the Danube and its chief tributaries. Indicate the watersheds which bound its basin, and name the river basins lying to the N. and W.

4. Describe the situation, and account for the name, of *Lombard Street, Regent Street, Chester, Cologne, St. Petersburg, Constantinople, Alexandria, Virginia, Pennsylvania, Adelaide.* Refer to seven of these names only.

5. Give dates, or approximate dates, and names for the following :—

(*a*) An Act for the union of England and Scotland.
(*b*) A Declaration suspending penal statutes against Romanists and Dissenters.
(*c*) The Statute authorising the burning of heretics.
(*d*) The defeat of the Spanish Armada.
(*e*) An Act preventing prisoners being kept long in gaol without trial.

6. Explain what is meant by the Star Chamber, Bill of Attainder, Ship Money, Act of Supremacy, Justices in Eyre, and Romescot.

7. Mention any twelve words, the spelling of which presents special difficulty to young learners ; and say by what sort of exercises you can best help such learners to spell them correctly.

8. Give a plan of the school-room, class-room, and playground of the school with which you are best acquainted. Give the dimensions also, and say for how many scholars accommodation is provided.

9. Explain the following terms :—*Syncopation, Allegretto, Legato, Diminuendo.*

10. If a person sells, for £18 each, fifty £10 shares in a company which pays a dividend of 8 per cent., and then invests the proceeds of this sale in the purchase of £5 shares in another company at £3 10s. each, find what difference is made in his income if the second company pays a dividend of 3½ per cent. Ans. £5.

11. Divide $2\frac{1}{4} - \frac{3}{8}$ of $1\frac{5}{6}$ by $\frac{1}{5}$ of $3\frac{1}{3} + \frac{7}{5}$, and reduce $\frac{4}{11}\frac{7}{7}\frac{9}{7}\frac{1}{7}$ to its lowest terms. Ans. $\frac{2}{7}\frac{7}{7}\frac{9}{8}$; $\frac{7}{5}$.

12. (*Men only.*) Write out Euclid I. 28.
From the vertex of an isosceles triangle a line is drawn to any point in the base. The square on a side of the triangle is equal to the square on the line so drawn, together with the rectangle contained by the segments of the base.

(*Women only.*) Enumerate the articles necessary for the proper cooking and saving of food in a labourer's cottage, with cost of each.

13. (*Men only.*) Solve

$$\frac{5x-9}{8} + \frac{7x-1}{10} = \frac{11x+17}{15} + 6. \quad \text{Ans. } 14\frac{9}{71}.$$

(*Women only.*) Say what you consider to be (*a*) the most wholesome, and (*b*) the cheapest method of using a shoulder of mutton for a cottage Sunday dinner, and give your reasons for your opinion.

14. (*Men only.*) The ages of two men are as 4 : 3 ; but 9 years ago they were as 3 : 2. Find their present ages.
Ans. 36 years ; 27 years.

(*Women only.*) State particulars, as to a young servant, respecting the best method by which to clean a hearthrug, a brass tap, an iron grate, a mahogany table, and a glass jug.

15. (*Men only.*) The arc of a sector of a circle is 55 ft., and the radius of the circle is 26¼ ft. Find the area of the sector.
Ans. 80 sq. yards $1\frac{7}{8}$ ft.

(*Women only.*) Describe the way to herring-bone flannel, to make a button-hole, to run a tuck, and to set-in gathers.

16. Put into French :—
(*a*) She had one day just finished her washing at the river.
(*b*) Sometimes she would take her Bible.
(*c*) What art thou doing there ? Fear not.
(*d*) I hope you will have some share in it.

17. Give as many idiomatic expressions as you can containing *coup.*

SECOND WEEK.

1. If you see anything wrong in the following sentences, correct them, and give your reasons :—
(*a*) I never remember to have seen him before.
(*b*) They deserve to receive condign punishment.
(*c*) Please to send either a written or a verbal reply.
(*d*) I intended to have pointed this out yesterday.
(*e*) He hoped every one had enjoyed themselves.
(*f*) The climate is as good, or even better than that of Madeira.

2. Give some examples of words in which the following syllables are contained, and show in regard to each group what is the common element of meanings, and from what language each word is derived :—*phil, rect, dom, sent, tele, tract.*

3. Give notes of a lesson on (*a*) An Eclipse of the Moon ; OR (*b*) The Employment of Colonists in W. Australia.

4. Write a short description of 'The Dependencies of Holland.' Mention places named by Dutch navigators which are not now politically connected with Holland.

5. What events and persons are referred to in the following quotations? Give dates :—

(*a*) 'Sea-kings' daughter from over the sea,
Saxon and Norman and Dane are we,
But we are all one in welcome of thee,'

(*b*) 'Vane, young in years, but in sage council old.'

(*c*) 'Her crew had seen Castile's black fleet
Beyond Aurigny's isle,'

(*d*) 'Rupert lost the day
By hanging on the flying crowd.'

6. Compare Henry II. and Edward I. with regard to :—
(*a*) Extending the dominions of the crown.
(*b*) Administration of justice.
(*c*) Relations with the clergy.

7. After a class has reproduced in writing a short story which you have previously read to it, what is your method of revising the exercises?

8. Give some hints for making oral exercises in arithmetic interesting.

9. Write the signature and ascending scale of F minor, using the minor sixth and the major seventh ; OR
Write an ascending minor scale (*lah* mode), using the minor or essential sixth, and the major or essential seventh.

10. A and B can reap a field in 10 days, A and C in 12 days, B and C in 15 days. They all work together for 4 days, when A leaves : B and C work together for 6 days more, when B leaves. In how many days will C be able to finish the work? Ans. 4 days.

11. A man buys railway debenture shares, paying 4½ per cent., and he buys at such a price that he gets 3¾ per cent. on his money. At what price does he buy? What sum must be invested in 2¾ per cent. consols at 96¼, in order to derive an income of £166 13s. 4d.? (Neglect brokerage.) Answers. 135 ; £5,833 6s. 8d.

12. (*Men only.*) Write out Euclid II. 6.
The straight line which bisects the base of an isosceles triangle at right angles shall pass through the vertex.

(*Women only.*) A leg of mutton weighing 8 lbs. is purchased for a family of six persons. How would you provide three savoury dinners for the whole family from this joint?

13. (*Men only.*) Solve—

$$\frac{3x+2}{10}=\frac{5y-11}{4}+1\ ;\ \frac{3x}{2}+\frac{5y}{y}=25\tfrac{1}{2}.$$

Ans. $x=12\frac{17}{18}$; $y=4\frac{3}{8}$.

(*Women only.*) Give plain rules for the preservation of health for a pupil-teacher, (*a*) who lives in the country a mile from her school, and (*b*) for a pupil-teacher in London living only a few doors away.

14. (*Men only.*) Two numbers are in the ratio of 5 :6. Show that four times their sum = 44 times their difference, no matter what the numbers may be.

(*Women only.*) Explain, as to an elder girl in your school, the way in which different kinds of furniture and any ornamental china or glass should be dusted and kept clean.

15. (*Men only.*) If a wheel revolves twice in 16½ feet, and if in passing round a circular bowling green it makes 200 revolutions, what is the area of the green in acres?
Ans. 4 acrs. 3 rds. 35 pls. 13⅔ yds.

(*Women only.*) What are the chief faults to be guarded against in making a three-cornered and diagonal darn?

16. Write a short account of the reign of Saul.

17. Describe the institution of the Last Supper.

THIRD WEEK.

1. One misfortune | which was imputed to William the Third | as a crime | was his bad English. | He spoke our language, | but not well. | His accent was foreign, | his diction was inelegant, | and his vocabulary seems to have been | no larger than was necessary | for the transaction of business. | To the difficulty which he felt | in expressing himself, | and to his consciousness | that his pronounciation was bad, | must be partly ascribed the taciturnity | and short answers | which gave so much offence. | Our literature he was incapable of enjoying | or understanding. | He never once | during his whole reign | showed himself at the theatre.

Write the above from dictation.

2. Paraphrase the above passage.

3. Describe briefly one of these cities :—*Edinburgh*, *Moscow*, *Paris*, *Berlin*.

4. Give notes of a lesson in Physical Geography, OR in Historical and Commercial Geography on 'The Mediterranean Sea.'

5. What were the points of difference between Cromwell and Parliament? Give reasons to account for the facts (*a*) that Cromwell was able to maintain his power, and (*b*) that the Protectorate could not be maintained after his death.

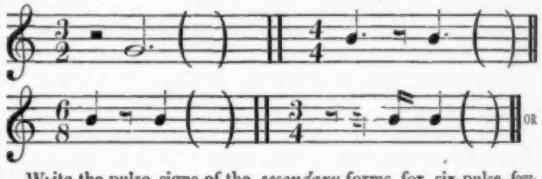
6. Which of our sovereigns were minors when they inherited the throne? By whom was the government carried on during their minority.

7. If the following passage from 'Hume's History of England' occurred in the reading-lesson of your highest class, say what words in it you would think it necessary to explain, and how you would explain them :—

'Stephen was possessed of industry, activity, and courage to a great degree ; though not endowed with a sound judgment, he was not deficient in abilities ; he had the talent of gaining men's affections, and, notwithstanding his precarious situation, he never indulged himself in the exercise of any cruelty or revenge. His advancement to the throne procured him neither tranquillity nor happiness, and though the situation of England prevented the neighbouring states from taking any durable advantage of her confusions, her intestine disorders were to the last degree ruinous and destructive.'

8. It is said that 'in teaching we should proceed from the known to the unknown.' Explain what this means, and show how it is applicable to a lesson on either Geography or Grammar.

9. Complete each of the following bars by adding one note at the end :—



OR

Write the pulse signs of the *secondary* forms for six-pulse, four-pulse, three-pulse measures.

10. What is the difference between the simple and the compound interest on £1,350, for 3 years at 5 per cent.?
Ans. £10 5s. 10d.

11. Knives are bought at 11 for 10s., and sold at 10 for 11s., what is the gain per cent.? Ans. 21 p.c.

12. (*Men only.*) Write out Euclid I. 33.
SQT is a triangle right-angled at Q. From S, on the side remote from T, a straight line SP is drawn perpendicularly and equal to SQ; a similar straight line TR is drawn perpendicular and equal to TQ. Show that the points PQR are in the same straight line.

(*Women only.*) Briefly describe the garments you would think most suitable to be made by children in the upper standards attending a rural school ; state the materials of which the garments should be made, and the approximate cost of each article.

13. (*Men only.*) Solve $\frac{x-12}{x-5}+\frac{x-5}{x-12}=2\frac{4}{35}$.
Ans. $x=29\frac{1}{2}$ or $-12\frac{1}{2}$.

(*Women only.*) Give an account of the best mode of washing (*a*) a flannel waistcoat, and (*b*) a linen shirt.

14. (*Men only.*) A labourer can save out of his weekly wages 10 per cent. His wages rise a shilling per week, but his expenses also increase 10 per cent. He can now save only 5 per cent. of his increased wages. Find his weekly wages. Ans. £1 3s. 9d.

(*Women only.*) Explain, as to a class of children, the difference between cotton, wool, linen, and silk ; and show the adaptation of each of these materials for clothing.

15. (*Men only.*) The side of a regular pentagon is 36 ins., and the perpendicular from the centre to the side is 25 ins. Find the area of the pentagon. Ans. 1 sq. yd., 6 ft., 90 ins.

(*Women only.*) Write out directions for cutting out and making a plain frock for a child twelve months old.

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR APRIL, 1894.

DAYS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	First Four Rules of Algebra, Proofs, etc. — Theoretical Needlework.	History from 1066 to 1199.	'De Bello Gallico,' Chapters 13 to 18, *or* 'La Jeune Sibérienne' pp. 22 to 29	Algebraic Fractions, with easy Denominators — Ingredients of Food	Dates from 827 to 1066	'De Bello Gallico,' Chapters 19 to 25, *or* 'La Jeune Sibérienne,' pp. 30 to 37	Algebraic G.C.M. (Theory and Practice) — Rules of Health	Dates from 1066 to 1307	Latin *or* French Grammar	Algebraic Factors — Miscellaneous Arithmetic	Dates from 1307 to 1461	'De Bello Gallico,' Chapters 26 to 30 *or* 'La Jeune Sibérienne' pp. 38 to 45
TUESDAY	Revise Definitions, Postulates, Axioms of Euclid I. — Calico Sampler	General Geography of North America	Science *or* Revision	Deductions upon Euclid, Book I. — Diagram of Chemise	Revise Geography of England	Science *or* Drawing	Deductions upon Euclid, Book II. — Flannel Sampler	General Geography of Australia	Science *or* Drawing	Second Book of Euclid — Calico Sampler	Repetition, Literature, and Penmanship	Science *or* Drawing
WEDNESDAY	Cube Root — Square Root	Latin *or* French Grammar	How to teach Reading	Clock Sums	Repetition, Literature, and Penmanship	How to teach Writing	Relative pitch of Keys and Musical Terms	Parsing and Analysis (see Questions)	How to teach Arithmetic	Stocks	Greek Roots	How to teach Grammar
THURSDAY	Algebraic Factors — Savings and Investments	History from 1199 to 1307	Parsing and Analysis (see Questions)	Algebraic G.C.M. (Theory and, Practice) — Preparation of Beverages	History from 1307 to 1377	Study Table of English Literature	Algebraic Fractions — Clothing and Washing	History from 1377 to 1461	English Composition on 'Governments'	Simple Equations — Miscellaneous Arithmetic	History from 1461 to 1547	Paraphrasing and Dictation
FRIDAY	First Sixteen Propositions of Euclid, Book I. — Flannel Sampler	General Geography of South America	Drawing *or* Revision	First Seven Propositions of Euclid, Book II. — Calico Sampler	Map of United States	All the Minor Scales and Signatures, Chromatic Intervals	First Thirty-two Propositions of Euclid, Book I. — Diagram of Chemise	General Geography of Polynesia (except Australia)	Stocks	Deductions upon Euclid, Book I. — Flannel Sampler	Map of Australia	Compound Interest
SATURDAY	Drawing *or* Revision	Science *or* Revision	Examination (Two Hours)	Drawing *or* Revision	Science *or* Revision	Examination (Two Hours)	Drawing *or* Revision	Science *or* Revision	Examination (Two Hours)	Drawing *or* Revision	Science *or* Revision	Examination (Two Hours)

16. Translate into English :—

Cependant une femme *s'approcha* pour l'interroger, Prascovie raconta l'affreuse nuit *qu'*elle avait passée dans le bois ; d'autres paysans s'arrêtèrent pour l'entendre. Le starost du village examina son passe-port, et déclara *qu'*il était en règle : alors la bonne femme *attendrie* lui offrit sa maison ; mais lorsque la voyageuse *voulut* se soulever, ses membres étaient tellement *engourdis* qu'on fut obligé de *la* soutenir. Elle avait perdu un de ses souliers, elle montra son pied *nu* et ses jambes enflées. Elle tâchait, *pendant* le séjour qu'elle y *faisait*, de se rendre utile, en balayant la maison, en *lavant* le linge ou en *cousant* pour ses hôtes.

17. Parse the italicised words of the above passage.

FOURTH WEEK.

1. Write a short essay on one of these topics :—

(*a*) Good Manners.

(*b*) The Importance of the Telegraph and Telephone from a Commercial Point of View.

(*c*) The Advantages of a School Library.

2. Write notes of a first lesson on the Analysis of a Simple Sentence.

3. In what parts of the British Isles are there to be found lead, salt, granite, slate, building-stone, peat, china-clay, and medicinal springs ?

4. Where are the under-mentioned places situated, and for what are they remarkable ?—*Archangel, Perim, Surat, The Landes, Fiji, Lagos, Buxton, Singapore, Cincinnati.*

5. State briefly the (*a*) extent of the dominions of, and (*b*) the kind of authority over these dominions possessed by three of the following :—Egbert, Alfred, Canute, William I.

6. When were the legislative unions of Scotland and of Ireland with England effected ? What circumstances led to these unions, and how were they accomplished ?

7. In giving a lesson on the Duke of Wellington, show what use you would make of comparison and contrast with any other character in history.

8. What rules have you learned to observe in giving out dictation ?

9. Write the signatures of the following keys :—A major, B minor, E♭ major, F♯ minor ; OR,

Re-arrange the following notes in order of pitch, placing the lowest notes first :—

s_1, t, fe, r^1, ra, se, d, ta, l_1, d^1.

10. Express ·481 and ·72 as vulgar fractions in their lowest terms, and their difference as a circulating decimal.

Ans $\frac{13}{27}$; $\frac{18}{25}$; ·2407.

11. Say how you would *prove* to a class of children—

(*a*) That five times six are the same as six times five.

(*b*) That one-seventh of three is the same as three-sevenths of one.

(*c*) That if *A* is $\frac{2}{3}$ of *B*, *B* is $\frac{3}{2}$ of *A*.

12. (*Men only.*) Write out Euclid II. 9.

Give the middle points of the sides of a triangle, to construct it.

(*Women only.*) A pupil-teacher, whose salary is £15 per annum, lives with her parents, who provide her with food and lodging free of cost, but nothing else. How can she best use her income ?

13. (*Men only.*) A purse contains only threepenny and fourpenny pieces, equal in value to £2 10s. 7d. If the number of threepenny and fourpenny pieces were interchanged the value would be £2 8s. 7d. Find the number of coins of each set.

Ans. 73 threepences ; 97 fourpences.

(*Women only.*) Describe the proper mode of nursing a patient suffering from some common disease, such as measles or chicken-pox.

14. (*Men only.*) The length of a garden exceeds its breadth by 50 yards ; the garden contains 9,375 yards. Find its length and breadth. Ans. 125 yards ; 75 yards.

(*Women only.*) '*All the materials we use for clothing we obtain from the animal and vegetable kingdom.*' Name these different materials, and describe their uses.

15. (*Men only.*) The parallel sides of a quadrilateral are 18 yards and 12 yards respectively, and the height of it is 16 yards. Find the area. Ans. 240 sq. yds.

(*Women only.*) State accurately (*a*) the amount of material required for a full-sized plain cotton shirt ; (*b*) the length of the shirt ; (*c*) the size round the neck and wrist ; (*d*) the length of the sleeve.

16. Prove from Scripture that the 'Holy Ghost is God.'

17. Explain :—

(*a*) In the provocation.

(*b*) In the day of temptation.

(*c*) Sabaoth.

(*d*) Honourable true and only Son.

(*e*) Hath magnified me.

(*f*) Shawms.

WELL-KNOWN TEACHERS AT WORK.

XXVII.—MR. T. CARTWRIGHT, B.A., B.Sc.,

Head Master, Long Lane Board School, Finchley, N.

IN the first week of January it fell to our lot to pay a long-promised visit to the school over which the subject of the present sketch so worthily presides. It was with a feeling akin to consternation that we awoke to find the thermometer considerably below freezing point, and locomotion rendered difficult by some inches of snow on the ground. Should we go? Should we wait for a more favourable day? We decided to go, and were agreeably surprised on our arrival to find a full school. It did not take us long to discover that Mr. Cartwright's scholars were like himself, not inclined to let difficulties stand in the way when duty has to be done.

Finchley is a semi-rural place, within easy distance of some of the busiest parts of the metropolis. Unlike many suburban districts, its rate of growth is not very rapid, and it still contains many old-fashioned quiet spots, which suggest nothing less than the neighbourhood of the greatest city in the world. Many of its inhabitants are employed in town, whilst the three great cemeteries belonging to London parishes which are situated within the limits of Finchley afford employment to a large proportion of its population.

The Long Lane Board Schools are arranged in two departments—a Mixed Department, and one for Infants. The Mixed Department, which has 520 children on the books, has accommodation for 420 children in seven class-rooms, arranged on three sides of a spacious and well-lighted central hall. From one end of the hall staircases lead on each side to a second floor, containing a head-master's room, rooms for the assistant masters and the assistant mistresses, a cookery room, and caretaker's apartments. In the basement is a ventilating fan worked by a gas-engine. A system of shafts, all communicating with the engine-room, take away the foul air from the class-rooms. The vacuum created by the working of the fan sucks out the foul air from the rooms, whilst the fresh air from outside enters over coils of hot-water pipes.

The central hall is adorned with numerous choice photographs and engravings. Above the head-master's rostrum, at the end of the hall, Fröbel's motto, 'Let us live for our children,' occupies a conspicuous position. The class-rooms throughout are well supplied with maps and diagrams.

In the company of our host, we make a tour of the school. Knowing something already of Mr. Cartwright's work, we were prepared for a great deal of

what we saw, but the actual reality far exceeded our anticipations.

A reply to a question of ours on the influence of the mixed system in schools elicited the fact that Mr. Cartwright is a strong believer in it, on the ground that it is the most natural organisation, and corresponds most closely to the life of the family. It exercises an influence for good on both sexes, and while affording daily opportunities of teaching boys consideration for the weaker sex, it diminishes any tendency to hoydenism amongst the girls.

The Musical Drill of the upper standard girls was first exhibited for our entertainment. Mr. Cartwright is fortunate in having such an able assistant as Miss Jonte, who is a *diplomée* of the Liverpool Gymnasium, and a specialist in drill. The most intricate movements were executed with grace and precision, but what struck us more than anything else was the evident enjoyment with which the girls entered into their lesson. We were not long in finding out that Mr. Cartwright is an enthusiast for physical education. Periodical runs across the country, in which the teachers take part, are organised for the boys, whilst swimming forms a regular part of the curriculum. The teaching of this subject is attended with some difficulty, as the boys have to go by train some distance off to the baths.

'Did you find any difficulty in getting the boys to pay the travelling expenses and the cost of admission to the baths?' we ask.

'There was no great difficulty on that score, as the Board paid the last item, but the difficulty rather consisted in the number of lessons being limited, on account of the time taken to get to the baths. We managed, however, to teach twenty boys to swim during last season.'

Sincerely Yours
Thos. Cartwright

A visit to the class-room occupied by the upper standard children enabled us to see that the teaching at Long Lane Board School develops mainly in a scientific direction. The teaching is not that pseudo-science teaching which is content with text-books and verbal descriptions. Experimental teaching is used wherever possible. Mr. Cartwright is fortunate in working under a School Board who recognise the fact that the best teaching cannot be given when the teacher is not supplied with proper apparatus. A very good lantern and a collection of astronomical slides were purchased by the managers at Mr. Cartwright's request. Few Board Schools of the ordinary type are so well stocked with apparatus for the study of chemistry. There is an ample supply of chemicals and reagents, a combustion furnace, a chemical balance, and other necessary pieces of apparatus. Some of the apparatus has been provided by Mr. Cartwright himself, who has also furnished the school with a good collection of rocks and minerals. A compound microscope has been provided by the head-master.

Botany and Chemistry are taken as Specific Subjects, and the Seventh Standard children are prepared for the Science and Art Examinations in Chemistry and Physiography. Both boys and girls take the first stage of Mathematics, in addition to the two subjects just mentioned.

As an instance of the practical character of the science teaching, we were told that the boys were taught to measure the rain-fall by means of a gauge. So accurately is this done, that the school calculation for last December only differed from that of the Meteorological Office by a small decimal. To enable the children to study apparatus of too costly a character to be provided for the school, they are taken to South Kensington Museum, when the scientific apparatus of the School of Science is on view.

In the work of the Third Standard we found a feature worthy of imitation. The formal teaching of composition commences in this standard. The practice of answering in complete sentences, which is cultivated from the First Standard upwards, aids considerably in making the teaching of composition a success.

A visit to the First Standard class-room afforded us a good example of Mr. Cartwright's many-sided activity and resourcefulness. The little ones were singing a song, of which the words and music were on the blackboard. Inquiry as to the author brought a broad smile on our host's face. We knew that Mr. Cartwright had been successful in literary and journalistic work, without dreaming that at the same time he was yearning to conquer another world in the shape of musical composition. We learned afterwards that the First Standard teacher had, on the previous afternoon, been at a loss for a song, when Mr. Cartwright set to work and forthwith

wrote song and words for the teacher. Mr. Cartwright believes that difficulties exist only to be overcome. He has written several school-plays, which have been performed with great success. The first of these was written on an occasion when, from some untoward circumstances, it was absolutely necessary to fill up a gap in the programme of an entertainment which was to come off in a short time. As the Long Lane School possesses a perfect storehouse of theatrical properties, no difficulty was found in mounting the play at short notice. The success of this first effort led Mr. Cartwright to make other attempts in the same direction. A glass plane for the teaching of model drawing is another production of Mr. Cartwright's labours.

We were particularly pleased to notice the harmony which exists between all the members of the staff of Long Lane Board School. If anything could exceed the respect and admiration which the members of Mr. Cartwright's staff have for their head, it would be the consideration and attention to their welfare which they experience at his hands. The ideal of a teacher's duty and responsibility which prevails at Long Lane Board School is no low one. As is the head, so are the members. All Mr. Cartwright's staff throw themselves into their work with a zeal which is second only to his own. Like many other men of strong individuality, Mr. Cartwright possesses the knack of getting the best possible work out of all his coadjutors.

Taking their cue from himself, all the staff endeavour to place themselves on a friendly footing with their young charges. A sort of big-brotherly feeling is cultivated, particularly towards older children. The element of fear finds no place in the discipline and methods of Mr. Cartwright's school. It was impossible not to notice the unconstrained yet respectful bearing of the children towards the teachers. No better proof of the kindly relationships which exist between children and teachers could be given than the success of the Old Boys' Dinner, which is held triennially. We were fortunate enough to be invited to one of these gatherings. The reception which Mr. Cartwright met with was simply overwhelming. The motto of the great German master, which has been adopted as the motto of the school, is no empty form of words. No personal inconvenience is allowed to stand in the way where the benefit of the children is concerned. To find out that something is worth doing in the interest of the children means with Mr. Cartwright that it shall be done. Having had occasion to remark the ignorance of Central London streets and sights which is often found in suburban children, Mr. Cartwright set himself to remedy it by taking his Sixth and Seventh Standard round the City, and familiarising them with objects of interest there. With the same object in view, a series of Frith's photographs of London scenes was obtained, which hang displayed in the central hall.

We have already mentioned that Botany and Chemistry are taken as specific subjects, and that the Seventh Standard take three subjects for the Science and Art Department. Geography and Grammar are taken as class subjects, and Drawing is taken for boys and girls alike. The highest grants in all these subjects are always obtained. In the science subjects the results have always been very good, on several occasions all the candidates passing. Since the raising of the standard last year, the percentage of passes has reached 50 per cent., a result which is far above the average for the country. The following report of H.M.I. of Schools is a sample of what is usually obtained at Long Lane. Additional value attaches to the report, as it is from the pen of Mr. J. A. Willis, who is not only an official of the Education Department, but an educational enthusiast into the bargain, a combination which does not always prevail in the ranks of the Inspectorate.

'I can continue to speak very highly of the manner in which this school is conducted and taught. The ideal of education arrived at here is a high one, perhaps higher than is within the reach of the ordinary child in this district, but the results in the more elementary subjects show that these also receive ample attention. I have pointed out a few matters to the master in which the results are less than excellent. On the other hand, the answering of the first class on geography (with history taken in connection) was a brilliant performance, embracing, as it did, almost an entire practical education in itself.'

It may surprise our readers to know that such an extended curriculum as that quoted above can be successfully worked, especially in a mixed school. The secret is explained by a feature of the work of Long Lane School, which is not as common as it should be in our elementary schools. Mr. Cart-

wright has made the study of mental science a hobby, and the work of his school proceeds accordingly on true pedagogic lines. Rule-of-thumb work is banished, and its place is taken by a rational system of education founded on a profound study of child-nature.

To encourage punctuality, and to secure a good attendance on Friday afternoons, the work of the week ends with an entertainment in the central hall, in which both teachers and children take part. The regular and punctual children are rewarded with front seats. We give the programme of one of these entertainments as a sample of the rest :—

PROGRAMME.

FRIDAY AFTERNOON, NOVEMBER 24TH, 1893, 4.30.

Front Seats reserved for regular and punctual children.

1. Piano Solo	'In Search'	Eva Coldham.
2. Sextette	'Patience'	The Sextette.
3. Song	'Farmer's Song'	Ern. Locke.
4. Recitation	'Month at School'	Alice Judd.
5. Trio	'Softly falls'	L. Morton, L. Joslin and L. West.
6. Song	'Sailing'	Mr. Cartwright.

God save the Queen.

It is, perhaps, because the Long Lane children get such frequent practice in appearing in public that the annual school-concerts are so popular and successful. Some of these concerts have been repeated as often as four times in succession. Out of the proceeds of the concerts a piano and library have been bought for the use of the school.

Before we give Mr. Cartwright's views on subjects of importance to teachers generally, we think it will interest our readers if we jot down his remarks on a point of great interest to teachers near to, but not actually in, the Metropolis.

'It has for years been a matter of great regret to me that no opportunities in the way of scholarships have existed in Finchley to enable deserving children to carry on their education beyond the curriculum of the elementary school. The Middlesex County Council founded last year 15 Technical Scholarships, and we were fortunate enough to get one of them. It seems to me unjust that although we are bound to the Metropolis by uniformity of interests our children are not allowed to compete for the scholarships open to children in the London Board Schools, merely because they happen to live a little to the north of an arbitrarily fixed point. We gain some success at public examinations. Last year, for example, five of my scholars passed the examination for Boy Copyists.'

'What are your ideas on the subject of the Inspectorate?' we ask.

'Lengthened experience of actual school-work should, in my opinion, be a *sine quâ non* for appointment to the Inspectorate. There should be but one grade of Inspectors, with a sufficient initial salary to attract the very best and most experienced teachers.'

We have already mentioned the attention which Mr. Cartwright pays to the theoretical side of teaching. He has made a study of the lives and opinions of the great educationists of all countries, and is in particular an admirer of Quick. The fruits of Mr. Cartwright's studies have appeared in the able series of articles on 'Educational Reformers' now appearing from his pen in the PRACTICAL TEACHER. He has also published 'Mental Science and Logic for Teachers,' a work which has had a wide circulation, and has received favourable notices in the home and colonial press.

A radical alteration of the present method of examining schools, and a thorough overhauling of the Science and Art Department and its methods, are earnestly advocated by Mr. Cartwright.

He is in thorough accord with the N.U.T. on the question of Superannuation. Mr. Cartwright is an earnest Unionist. He was one of the Presidents of the now defunct North Middlesex Association.

It should also be mentioned that he is a staunch teetotaller, and an earnest temperance advocate.

In addition to his work in school, Mr. Cartwright is a Science Lecturer in the employ of the Middlesex County Council, and Lecturer on Physiography to the Birkbeck Institution. He is also sub-editor of the *Infants' Mistress*. It was on his suggestion that the idea of conducting a number of English Infants' Mistresses to Germany for the purpose of viewing the Kindergarten system at work in the land of its birth was adopted. The project has been eagerly taken up, and will become an accomplished fact during the next summer holidays. In addition to Mr. Cartwright's well-known contributions to the PRACTICAL TEACHER, he is writing a series of papers for the *Girls' Mistress* on 'How to get the L.L.A. degree.'

Mr. Cartwright was a Pupil Teacher at St. John's National School, Dudley. He was subsequently Assistant-Master at No. 8 Board School, Greet Bridge, St. Luke's School, Victoria Docks, E., and Westcott Street Board School, S.E. His first report at the last-named school was as follows: 'The condition of the Second Standard is very creditable to Mr. Cartwright. Their conduct and attainments show what may be done with the least promising material by honest labour steadily maintained throughout the year.' His last report at the same school is equally creditable to him: 'Mr. Cartwright's class has passed a first-rate examination. His attainments and capabilities entitle him to a higher position than that of Assistant-Master.'

After leaving Westcott Street, Mr. Cartwright became Assistant-Master at Queen's Gardens Board School, Brompton, S.W., and afterwards at Everington Street, Chelsea.

For two years Mr. Cartwright was Responsible Master of Waterloo Street Evening School, Hammersmith.

While in the service of the London School Board, Mr. Cartwright took the B.A. degree of London University.

In 1886 he was appointed to his present school, and in 1889 he added the B.Sc. degree of London University to the degree he already held.

We left Long Lane Board School feeling that Mr. Cartwright is worthy, and more than worthy, of the honour done him by this journal. Amongst the able teachers who have found a place in our gallery of fame he takes a high rank. The Finchley School Board, and still more the Finchley children, are to be congratulated on their good fortune in having such a skilful and earnest educationist working among them. That he may long continue to adorn the profession he loves so well will be the wish of every reader of the PRACTICAL TEACHER, and, not least, of the writer of the present sketch.

NEW COMPOSITION STORIES.—STANDARD V.

Suitable for 'Unseen Tests' in Reading also.

147.

A Picture with Living Eyes.—During the Peninsular war a party of British officers took possession of a farm-house, and, having partaken of supper, were seated round the table discussing their plans. Suddenly one of the officers started, and said that he was quite sure that the eyes in a large picture had moved. He said if he saw them move again he should fire. The next moment he drew out his pistol and aimed at the picture. There was a groan and then a fall. On proceeding to the spot, they found that a Frenchman had skilfully cut out the two eyes of the painting, so that he could see through with his own, and had concealed his body in a recess at the back to see and hear what passed, so that he might discover the plans of the English.

148.

The Sailor's Joke.—An Italian boy was selling statues of well-known public men and others when a man passing by accidentally knocked one over, breaking an arm off, whereupon the boy commenced to cry. A sailor close by inquired the nature of the boy's grief, and he replied: 'My statue of Mr. Gladstone is broken.' 'Can't you mend it?' asked the man. 'No,' replied the boy tearfully. 'Then knock one of his eyes out, and sell him for Nelson,' replied the seaman, much to the amusement of the crowd who had gathered round.

149.

How she Cooked the Lobster.—A lady who had engaged a country girl as a general servant, brought a live lobster from the market, with which to test her abilities as cook. Having given her careful instructions how to cook it, she added, 'Don't boil it too long, or you will spoil its colour.' 'All right, ma'am,' said the confident girl. When the lobster appeared on the table it was jet black. 'Why, Sarah,' said the lady, 'You have not boiled this so long as I told you.' 'Oh, yes, I have, ma'am; I did it just as you told me.' 'But,' said the lady, 'if you had, it would be red—not black.' 'Oh,' said the girl, 'it did go red, and I thought I had boiled it too long, and spoilt its colour, so I blackleaded it.'

150.

Why he disliked Marmalade.—The other day a clergyman invited the members of his Bible-class to tea. They all seemed to enjoy the good things provided for them. But the clergyman's wife noticed that one lad refused to help himself to the marmalade. She thought she would try him again, but he still refused; so she asked him if he did not like marmalade. He replied, with a broad grin: 'No thank you, ma'am; I works where they make it.'

151.

Queer Glass.—An English gentleman returned from India, brought with him a Hindoo boy as servant. The boy had always lived in a hot country, and had never seen water in its solid form as ice. One winter morning he brought in from a bucket in the yard a large piece of ice. Running up to his master, he eagerly cried: 'See, master, what a large piece of glass I have found.' His master said that it looked very wet, and jokingly told him to put it in the oven to dry. The boy carried it away to the kitchen, but soon returned with the partly melted ice. He looked quite astonished as he entered his master's room: 'Oh, master,' he cried, 'this is the queerest glass I ever saw. The more I dry it the wetter it gets.'

152.

The Donkey's Trick.—A gentleman had a beautiful donkey which was up to all kinds of antics. It was generally fed with chopped hay and oats placed in a bucket in the farmyard. When this was put before him, he began to eat most vigorously. During this process he kept wheeling round the bucket, kicking out in a very vicious manner, to keep away the young colts, heifers, and pigs, which were thus obliged to keep at a respectful distance. On one occasion, however, an old sow with a litter of young pigs managed to get her nose into the bucket, whereupon the donkey brayed close to her ear and set up such an unearthly noise, that she beat a hasty retreat, followed by her little ones in a state of great consternation.

153.

A very old Table.—A wealthy man was once exhibiting to some acquaintances a table which he had bought, and which he said was five hundred years old. 'That is nothing,' said one of the company. 'I have in my possession a table which is more than three thousand years old.' 'Three thousand years old!' said his host; 'that is impossible. Where was it made?' 'Probably in India.' 'In India! What kind of table is it?' 'The multiplication table!' replied his friend.

154.

A Sympathetic Shoeblack.—At the corner of one of the streets a shoeblack was asked to polish the boots of a well-dressed gentleman. The latter was unfortunate in having a deformity, which compelled him to wear a boot on one of his feet with an exceedingly thick sole, thus endeavouring to make up mechanically for what nature had denied him. 'How much shall I pay you?' he asked of the boy. 'A penny, sir.' 'Oh, but you shall have more than a

penny for polishing my boots,' said the gentleman, tapping the thick sole with his cane. 'No, sir,' said the boy; 'a penny is enough, I don't want to make money out of your hard luck.'

NEW READING TESTS.—STANDARD III.

Suitable for 'Unseen Tests' in Dictation also.

125. It must not be supposed that all toy-sellers are toy-makers. In some cases, it is true, keepers of toy-shops have special articles which they manufacture; but the great bulk of their stock is drawn from many quarters. The variety of materials used in making toys will suggest the engagement of several classes of work-people in the business, and such is really the case.

126. A little girl went recently to visit her grandfather in the country. She was fond of milk, but firmly refused to drink any while there, without giving any reason. 'You had nice milk to drink, didn't you?' 'I guess I didn't drink any of that milk!' she replied. 'Do you know where grandpa got it? I saw him squeeze it out of an old cow.'

127. Beavers are curious little creatures, and live all the winter in warm comfortable houses, which they make themselves. These they build in small rivers, which, from different causes, are liable to be dried up during long frosts, and to provide against this they form long walls or 'dams' as they are called, all across the rivers.

128. A little boy carrying some eggs home from the shop dropped them. 'Did you break any?' asked his mother when he told her of it. 'No,' said the little fellow; 'but the shells came off some of them.'

129. There is a very pretty custom among the farmers in Norway. On Christmas morning the farmer's wife carries bread to distribute among the poor; while the farmer places a sheaf of corn on a pole for the birds. The pole is sunk in the snow-covered ground and left for the birds; and you may be sure they enjoy their Christmas cheer as much as the farmer and his children.

130. The flamingo is found in the tropical and temperate regions, and frequents marshes and shallow lakes. In deep waters they swim, but they prefer to wade, for they can bend down their necks and rake the bottom with their bills in search of food. Flocks of these birds with their red plumage when seen from a distance have been likened to troops of soldiers.

131. The children ran out, and sure enough there was a big mysterious package so done up with straw and string that it was difficult to guess what could be inside. You can imagine, then, the pleasure and excitement of all, when, after great trouble, the fastenings were cut, the parcel undone, and it proved to be a splendid mail cart, painted bright red. (H.M.I.'s Test.)

132. Why need I strive and sigh for wealth?
It is enough for me
That Heaven hath sent me strength and health,
A spirit glad and free:
Grateful these blessings to receive
I sing my hymn at morn and eve.

NEW DICTATION TESTS.—STANDARD IV.

Suitable for 'Unseen Tests' in Reading also.

68.

The blue crane is one of the most useful of the feathered tribes. Unlike some other herons, its neck is stretched to its full length while waiting for prey. It is generally found standing alone in the field. It seldom misses its mark; when it does, as if disgusted at its blunder, it spreads its wings, and with its long legs stretched out behind, takes flight for another field. When the blackbirds flock in great numbers, picking up the scattered grain, the crane will often stand motionless till the birds gather round within reach, when it will send its sharp bill through one in an instant.

69.

Cats, large and small, make the most careful toilet of any class of animals, excepting some of the opossums. The lions and tigers wash themselves in exactly the same manner as the cat, wetting the dark, indiarubber-like ball of the forefoot and the inner toe, and passing it over the face and behind the ears. The foot is thus at the same time a face sponge and brush, and the rough tongue combs the rest of the body. Hares also use their feet to wash their faces.

70.

It is said that engravers in Germany harden their tools in sealing-wax. The tool is heated to whiteness and plunged into the wax, withdrawn after an instant and plunged in again, the process being repeated until the steel is too cold to enter the wax. The steel is said to become after this process almost as hard as the diamond.

71.

According to competent authorities, the most curious book in the world is one preserved in the National Library at Paris. It is neither written nor printed—all of the letters of the text being cut out of each folio upon the finest vellum, and being interlaced with blue paper, it is read as easily as the best print. When the precision and minuteness of the letters are considered, the labour and patience bestowed upon it must have been excessive.

72.

An American paper tells the story of how a Washington lady sowed the seed from one head of barley four years ago. She harvested the crop with a pair of shears and sowed the grain secured the next year, again harvesting it with her shears. The next crop her father cut with a grass scythe, getting enough barley from this crop to sow forty acres last spring, which averaged forty bushels to the acre when threshed, making a total yield of 1,600 bushels from one head of barley in four years.

73.

If the seed of corn or other vegetables be placed in the earth where the heat of the sun's rays cannot penetrate, the seed will be preserved, but remain dormant for years for want of its proper stimulant; but the instant you raise the seed so near the surface of the earth as to allow the sun's rays to act upon it, the natural stimulus of heat soon causes the germ to burst the bounds of its confined husk, and prepares the stem to grow.

74.

There is a tendency on the part of pupils to burst out laughing and giggling at every little thing that is said. Laughing may be healthy, but there is certainly no good in laughing when you cannot tell what you are laughing at. When a scholar gets up to recite and makes a slight mistake, there are some foolish enough to burst out laughing although nothing funny has been said. This not only causes disorder, but is an insult to the person who is reciting. When you hear anything really funny then laugh, but by laughing at everything you only show your ignorance. (H.M.I.'s Test.)

75.

Boys of spirit, boys of will,
  Boys of muscle, brain and power,
Boys to work with all their skill,
  These are wanted every hour;
Not the weak and ignorant,
  Who all troubles magnify,
Not the idler's cry, 'I can't,'
  But the nobler one, 'I'll try.'

STANDARDS V.–VII.

59.

One of the many uses to which paper is now put is that of making gas pipes. Manilla paper is cut in strips equalling in width the length of the pipe to be made. These are passed through a vessel filled with melted asphalte, and then wrapped firmly and uniformly round an iron core, until the required thickness is attained. The pipe is then subjected to powerful pressure, after which the outside is strewn over with sand and the whole cooled in water. The core is then removed, and the outside of the pipe coated with a waterproof composition. These pipes are claimed to be perfectly gas-tight, and are said to be much cheaper than iron pipes.

60.

The Queen's two railway saloons for Continental journeys are the private property of her Majesty, and are kept at Brussels. They are connected by a passage, are fitted with electric bells, and lighted with oil lamps, as the Queen does not like the electric light for reading and writing. The day saloon is furnished with sofas, armchairs, and various kinds of footstools, all covered with blue silk, with fringes and tassels of yellow; the walls are hung with blue and pearl-grey silk brocaded with the rose, shamrock, and thistle. There is a writing table of walnut wood, two small tables, and one on which meals are served during a journey.

61.

Meat is too stimulating a form of diet for the young, whose sole business is to grow; milk, eggs, butter, and bread-stuffs they should have without stint, with a liberal supply of fruits and vegetables in their season. With adults the case is different. A man is more concerned with the expenditure of his energies than with the mere building up of them, and the problem with him is mainly one of economy. The less energy he expends on digestion the more he will have to spare for the exercise of his higher functions, and since meat supplies the maximum amount of nourishment in proportion to the labour involved in extracting and assimilating it, he will, if he be a brain-worker, make it the staple article of his diet.

62.

In early times it was the fashion for all ladies and gentlemen to have their own spoons and spoon-cases, which they carried with them wherever they went. Two hundred years ago we find frequent mention in the newspapers of a 'lost case, containing a knife, fork, and silver spoon.' The spoon was usually described as bearing the crest of the owner upon its handle. The 'apostle spoons' were a dozen

of these silver implements, each containing an image of one of the apostles in relief upon its handle, sometimes with and sometimes without his name. In case emblems were used instead of names, St. James would be attired as a pilgrim; St. Jude was usually pictured with a club, the emblem of his martyrdom, or with a boat to show his occupation; St. Simon with a saw, because he was sawn asunder.

63.

In some of the Malay Islands the cocoanut is obtained in a curious manner. An enormous crab is found there, it is said, that lives on the fruit, climbing the trees and tearing the nuts off, breaking them by either hurling them down, or tearing off the husk, and then beating them against the rocks with its huge claws. The husk that the crabs take from the fruit they carry to their holes at the foot of the trees, and make a bed of it; and, knowing this, the Malays visit and rob the crabs once or twice a year, using the husks to weave into mats.

64.

The word 'gladness' carries us back to the old days when the greater part of Europe was covered with sullen and almost impenetrable forest, in the clearings of which our ancestors grouped their savage little villages. One cannot realise the gloom and horror of those leagues of matted, swampy, forest lands. A clearing amongst the huge old oaks, beeches, and pines—an open space where the cheerful sunlight might fall and the pleasant sky overhead might be seen—was indeed a happy spot; and so the early forest-dwellers named it. It was called a glade—a bright, shining place. Pleasant passages in a man's life recalled the sunlit glades; and how could they find a fresher, sunnier, more wholesome word for happiness than 'gladeness'—gladness! (H.M.I.'s Test.)

65.

The Umbrella Bird, which has some resemblance to a crow both in size and plumage, is so called from a wide crest which spreads out above its head like a parasol. This crest is composed of long slender feathers. The shafts are white, and the plume glossy blue, hair-like, and curved outward at the tip. When the crest is laid back, the shafts form a compact white mass sloping up from the top of the head, and surmounted by the dense hairy plumes, but when fully spread the top forms a perfect, slightly elongated dome, of a beautiful shining blue colour. The length of this dome from front to back is about five inches, the breadth, four-and-a-half inches. This bird is a native of the islands of the South American rivers, being seldom if ever seen on the mainland.

66.

Who are the wealthy ones of earth?
The men who own broad lands of worth,
And rent-rolls long and mansions fair;
Who linen fine and broadcloth wear;
We call these rich, but yet I say
This world holds greater wealth to-day.
The man his fellow-men may trust,
Whose dealings honest are and just;
The man whose lips do own no lie,
Whose soul is clean beneath God's eye;
Whose mind is never conscience-tossed
In long night hours by vain remorse;
This man, I say, owns wealth so great,
'Tis measured by no earthly weight.

OUR 1894 CERTIFICATE CLASS.

BY DR. GEORGE BEACH, M.A.,

Co-Author of a 'Manual of our Mother Tongue,' 'A Girls' Arithmetic,' Author of 'Elements of English,' 'Entertaining Readers,' 'Historical Readers,' etc.

1. MATHEMATICAL HINTS.

(*a*) The radii of the ends of a frustum of a right circular cone are 7 ft. and 8 ft. respectively; and the height is 3 ft. Find the volume of the cone from which the frustum was obtained.

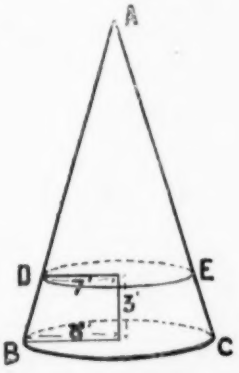
[*Note.*—Volumes of similar solids are as the cubes of corresponding lengths.]

Volume of frustum BDEC $= \frac{1}{3}\{(8^2 + 7^2 + 8 \times 7)3{\cdot}1416\} \times 3 = 530{\cdot}9304$.

Now the cones ADE and ABC are similar, and 7 and 8 are similar lengths (radii).

$\therefore \frac{ADE}{ABC} = \frac{7^3}{8^3}$;

or $\frac{ABC - ADE}{ABC} = \frac{8^3 - 7^3}{8^3} = \frac{169}{512}$;



But ABC — ADE = frustum BDEC.

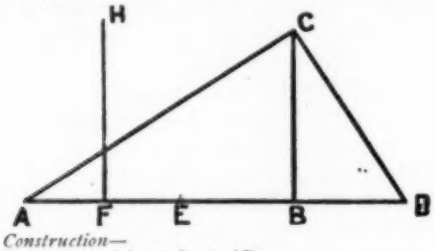
$\therefore \frac{BDEC}{ABC} = \frac{169}{512}$;

or $\frac{530{\cdot}9304}{ABC} = \frac{169}{512}$.

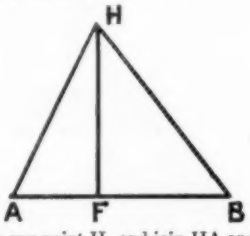
$\therefore ABC = \frac{530{\cdot}9304 \times 512}{169} = \underline{1608{\cdot}5 \text{ nearly.}}$

$\therefore$ Vol. of cone $= \underline{1608{\cdot}5}$ cu. ft.

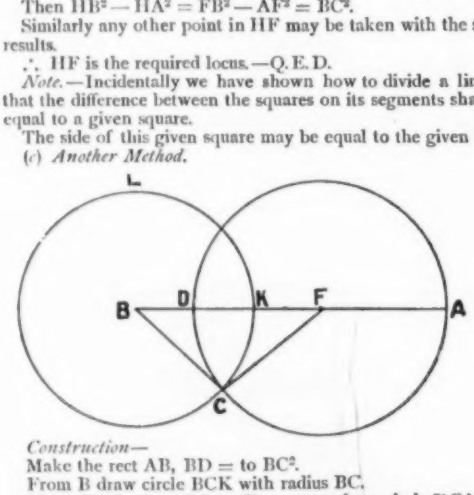
(*b*) Given a base AB to find the locus of a series of triangles, the difference of the squares upon whose sides shall equal the square upon CB.



Construction—
Erect CB at right angles to AB.
Join AC and draw CD at right angles to AC.
Produce AB to D.
Make BE = BD, and bisect AE in F. From F, draw FH at right angles to AB. Then FH is the required locus.
Proof—
Because ACD is a rt-angle a circle can be described about ACD with AD as diameter ∴ AB, BD = BC² (III. 35) or (II. 14).
∴ AB, BE = BC², but AB = AF + FB, and BE = FB — AF.
∴ rect AB, BE = rect contained by sum and difference of FB and AF.
∴ rect AB, BE = FB² — AF² (II. 5, Corol).
∴ BC² = FB² — AF².



In HF take any point H, and join HA and HB.
Then HA² = HF² + AF² (I. 47),
and HB² = HF² + FB² (I. 47).
Then HB² — HA² = FB² — AF² = BC².
Similarly any other point in HF may be taken with the same results.
∴ HF is the required locus.—Q.E.D.
Note.—Incidentally we have shown how to divide a line so that the difference between the squares on its segments shall be equal to a given square.
The side of this given square may be equal to the given line.
(*c*) *Another Method.*



Construction—
Make the rect AB, BD = to BC².
From B draw circle BCK with radius BC.
Bisect DA in F, and from F as centre draw circle DCA.
Join BC and CF. Then perp. to AB from F is the required locus.
Then ∵ AB, BD = BC², ∴ BC touches circle ADC, and BCF is a right angle (III. 37).
But AB = AF + FB, and BD = FB — AF.
∴ rect AB, BD = FB² — AF².
∴ BC² = FB² — AF², etc.
Note.—Incidentally we learn how to solve the following :—
AB is a given straight line, and B the centre of a given circle LKC.
It is required to find point F in AK, such that the tangent AC to LKC shall = AF.
Proof.—(*See* last diagram.)
∵ BC is perp. to CF ; ∴ CF is perp. to BC ; ∴ CF touches LKC, and CF also = FA.—Q.E.D.

(*d*) *To shew that* $m - n$ *will always divide* $m^a - n^a$.

$$m - n)m^a - n^a (m^{a-1}$$
$$\underline{m^a - m^{a-1}n}$$
$$m^{a-1}n - n^a = n^a(m^{a-1} - n^{a-1}).$$

Now $m - n$ will divide $m^a - n^a$ if the remainder $(m^{a-1} - n^{a-1})n$ will divide by $m - n$.
But $m^{a-1} - n^{a-1}$ is similar to $m^a - n^a$.
∴ $m - n$ will divide $m^{a-1} - n^{a-1}$ if it will divide $m^{a-2} - n^{a-2}$.
∴ ,, ,, ,, ,, ,, $m - n$,
but this it will do.—Q.E.D.
This proof is, we believe, quite new, and has the merit of introducing the student to the inductive method.
Note particularly the case where $n = 1$, then $m - 1$ will always divide $m^a - 1$.

(*e*) *To show that* $m + n$ *will always divide* $m^a + n^a$, *when* a *is odd.*
As a is odd, let it $= 2b + 1$.

$$m + n)m^{2b+1} + n^{2b+1}(m^{2b}.$$
$$\underline{m^{2b+1} + m^{2b}n}$$
$$-m^{2b}n + n^{2b+1} = -n(m^{2b} - n^{2}).$$

Now divide $m^{2b} - n^{2b}$ by $m + n$.

$$m + n)m^{2b} - n^{2b}(m^{2b-1}$$
$$\underline{m^{2b} + m^{2b-1}n}$$
$$-m^{2b-1}n - n^{2b} = -n(m^{2b-1} + n^{2b-1}).$$

∴ $m+n$ will divide $m^{2b+1}+n^{2b+1}$ if it will also divide $m^{2b-1}+n^{2b-1}$.
∴ ,, ,, ,, ,, ,, ,, $m^{2b-3}+n^{2b-3}$.
∴ ,, ,, ,, ,, ,, ,, $m + n$,
but this it will do.—Q.E.D.

(*f*) To show that $m + n$ will always divide $m^a - n^a$, when a is even.
As a is even, let it $= 2b$,
The result then follows at once from the first step of (*e*).

(*g*) *If the sum of the digits of any number will divide by* 9, *the number itself will also divide by* 9.
Let the digits be w, x, y, z.
Then the number will be $1000w + 100x + 10y + z$.
Then $(1000w + 100x + 10y + z) \div 9$

$$= 111w + 11x + y + \frac{w + x + y + z}{9}.$$

∴ The whole number will be divide by 9 if the sum of its digits is divisible.—Q.E.D.

(*h*) *If the digits of any number be transposed in any way, and subtracted from the original number, the difference is divisible by* 9.
Let the digits be w, x, y, z.
Let them be transposed in the order x, z, w, y.
The original number will be $1000w + 100x + 10y + z$.
The transposed number will be $10w + 1000x + y + 100z$.
The difference will be $990w - 900x + 9y - 99z$,
which is divisible by 9.—Q.E.D.

(*i*) The property shown in (*g*) is not inherent in the figure 9 because of itself, but on account of $9 = (10 - 1)$, where 10 is the radix of the scale of notation.
In any scale of radix n, *the whole number will divide by* $n - 1$, *if the sum of the digits will so divide.*
Let w, x, y, z, be the digits.
Then the number is $wn^3 + xn^2 + y^n + z$.
Then $(wn^3 + xn^2 + y^n + z) \div (n - 1)$

$$= [\text{See } (d)]\, w\left(n^2 + n + 1 + \frac{1}{n-1}\right) + x\left(n + 1 + \frac{1}{n-1}\right) + y\left(1 + \frac{1}{n-1}\right) + \frac{z}{n-1}$$

$$= w(n^2 + n + 1) + \frac{w}{n-1} + x(n+1) + \frac{x}{n-1} + y + \frac{y}{n-1} + \frac{z}{n-1}$$

$$= w(n^2 + n + 1) + x(n+1) + y + \frac{w + x + y + z}{n-1}.$$

That is, the whole number will divide if its digits so divide.—Q.E.D.

(*j*) *Any number will divide by* 11 *if the difference of the sums of the alternate digits will divide by* 11.

Let w, x, y, z, be the digits.

Then the number is $w \times 10^3 + x \times 10^2 + y \times 10 + z$.

Then $(w \times 10^3 + x \times 10^2 + y \times 10 + z) \div (10 + 1)$

$$= w \times 10^2 - w \times 10 + w - \frac{w}{10+1} + x \times 10 - x + \frac{x}{10+1} + y - \frac{y}{10+1} + \frac{z}{10+1}$$

$$= 100w - 10w + w + 10x - x + y - \frac{w - x + y - z}{10+1}$$

$$= 91w + 9x + y + \frac{(x+z) - (w+y)}{10+1}.$$ —Q. E. D.

(*k*) The property shown in (*j*) is not peculiar to the number 11 except so far as $11 = 10 + 1$ where 10 is the radix of the scale.

In any scale of radix n, the whole number will divide by $n + 1$ if the difference of the sums of the alternate digits will divide by $n + 1$.

Let w, x, y, z, be the digits.

Then the number is $wn^3 + xn^2 + yn + z$,

and $(wn^3 + xn^2 + yn + z) \div (n + 1)$

$$= w\left(n^2 - n + 1 - \frac{1}{n+1}\right) + x\left(n - 1 + \frac{1}{n+1}\right) + y\left(1 - \frac{1}{n+1}\right) + \frac{z}{n+1}$$

$$= w\left(n^2 - n + 1\right) - \frac{w}{n+1} + x\left(n - 1\right) + \frac{x}{n+1} + y - \frac{y}{n+1} + \frac{z}{n+1}$$

$$= w(n^2 - n + 1) + x(n - 1) + y + \frac{(x - z) - (w + y)}{n + 1}.$$

—Q. E. D.

II. Notes on the English Subjects.

(*a*) The Right Honourable Thomas Babington Macaulay, first and only Baron Macaulay of Rothley, was born on 25th October 1800, at Rothley Temple, Leicestershire. He was the eldest child of Zachary Macaulay, a zealous and devoted fellow-advocate with Wilberforce of negro emancipation. His grandfather, the Rev. John Macaulay, is mentioned with esteem in Dr. Johnson's 'Tour to the Hebrides.' Lord Macaulay's parents were intimate with Hannah More, whose correspondence reveals ample memorials of his childhood.

From 12 to 15 years of age he was placed under the careful training of the Rev. G. Preston, and during this period acquired a good knowledge of the classics, and no mean skill in English versification.

For the next three years he applied himself to omnivorous reading, and at 18 years of age entered Trinity College, Cambridge.

Here he distinguished himself by his oratory at the 'Union,' by twice carrying off the Chancellor's medal for English verse, by obtaining a scholarship, his degree, and a fellowship.

Between June 1823 and November 1824 he contributed to *Knight's Quarterly Magazine* both in prose and verse.

A year later his celebrated 'Essay on Milton' appeared in the *Edinburgh Review*, and in another six months he was called to the Bar at Lincoln's Inn.

In 1830 Macaulay entered 'The House' for Lord Lansdowne's pocket borough of Calne, on the eve of the Reform Bill agitation.

This movement he assisted so greatly by his speeches that in 1832 he was elected for Leeds and appointed Secretary to the Board of Control.

In his new position he showed that he could grapple with one of the greatest of our imperial problems—the government of India. Accordingly in 1835 he was sent to India as president of a commission to draw up a new code, and as fifth member of the Supreme Council at Calcutta.

After two years of most useful labour our author returned to England qualified to write such brilliant essays as those of Clive and Hastings, and independent financially of both political parties and publishers.

Meanwhile from 1825 to 1844 his masterly essays appeared at not infrequent intervals in the *Edinburgh Review*. His 'Lays of Ancient Rome' was published in 1842.

Returned to England, he declined the office of Judge-Advocate-General offered him by the Whigs, but was elected M.P. for Edinburgh in 1839, held the Secretaryship of War till 1841, and during 1846, 1847 was Paymaster-General of the Forces.

Shamefully rejected by Edinburgh in the latter year, yet the 'Modern Athens' somewhat rehabilitated itself by returning Macaulay in his absence at the head of the poll in 1852.

Four years before this had appeared the two first volumes of his 'History of England,' two others were published during his life-time, and a fifth and fragmentary volume since his death.

Just, however, at the pinnacle of his fame, his health began to fail. Only twice after 1852 did he speak in the Commons, and in 1856 illness compelled him to resign his seat.

Eighteen months later he was created a peer, through Lord Palmerston's recommendation—the first time in our history that literary merit had been recognised by such a distinction.

The new peer never addressed 'The Lords,' for in less than 2½ years he died suddenly and unexpectedly at his residence, Holly Lodge, Kensington, 28th December 1859.

His life and letters were published by his nephew, Sir George Trevelyan, in 1876.

(*b*) Very strongly can we recommend to our 1st Year *Women* Students the edition of Macaulay's Essay on Moore's Life of Byron, edited by Rev. Morley Stevenson (Principal of Warrington Training College) and Rev. R. A. Whalley, and published by Messrs. Mackie and Co., Warrington, for one shilling and sixpence.

There is a good sketch of Byron's Life, and a handy epitome of the essay itself. The notes are full and scholarly, and evince thorough acquaintance with Whitehall requirements.

Messrs. W. and R. Chambers issue a fourpenny edition, which should also be bought, as it is very suitable for interleaving.

(*c*) In studying the authors it is well first to read them through a time or two merely for enjoyment. Next a synopsis of their contents should he compiled, unless the text book itself contains one.

Further, taking the synopsis as the skeleton, it must be ascertained by the student whether he can clothe it with the dialogue and circumstance of the play, etc., and reproduce the substance of any given act.

The matter thus known, the characters of the drama, etc., should be investigated both independently and in inter-relation.

The editions recommended in these pages afford here especially valuable assistance.

Proceeding, our readers can now attack the allusions and the notes, and lastly the parsing, analysis, and paraphrase.

This method is, we believe, the most logical, developing as it does from mere perusal to reproduction as paraphrase.

Unfortunately, external considerations do not allow us to adopt this method in its entirety, but to it we shall cling as much as possible.

III. Model Answers to 1893.

SCHOOL MANAGEMENT.

Men and Women—Second Year.

Candidates must not answer more than FIVE questions from either section, nor more than EIGHT questions in all.

N.B.—If more than EIGHT questions are answered, only the EIGHT answers coming first on the paper will be revised.

Question 1, on Registration, must be answered by all Candidates.

Section I.

1. (*a*) What are the duties of the managers respecting each kind of register?

The Managers must *provide* suitable registers, viz., those for (α) Admission, (β) Attendance, (γ) Summary, and (δ) Half-Time. Each of these registers should be signed on the Title-Page by the Correspondent of the School, with the date at which it was supplied to the Teacher. The Managers must furnish from these registers all returns called for by the Department or Parliament, and to the Local Authority certain attendance returns. They are held responsible for the efficient verification of the registers by visiting the school without notice once a quarter and applying various tests. Not only must accuracy, but posting up to date be examined.

The result of each such visit should be entered by the visiting Manager in the log-book, dated and signed by him.

At the close of the school-year they should also check the number of times the school has been opened, and at least 10 per cent. of the attendance totals. By the above means the certificates required in 'Form IX' can be veraciously given.

(*b*) To what extent may pupil-teachers be employed in registration?

A Pupil-Teacher who has completed his second year may register the attendance of his own class. A first or second year Pupil Teacher may not be employed in registration.

(*c*) Why must no children be allowed to attend without having their names entered on the Admission and Class Registers?

No child must have its name on the Class Register without being enrolled in the Admission Registers. If its name be omitted from the former the following consequences ensue, or may ensue:—

(α) *The child* may lose its labour certificate.
(β) *The parent* may be unjustly fined for neglecting to send the child to school.
(γ) *The teacher* may be suspended for faults of registration.
(δ) *The managers* may lose fee and other grants.
(ε) *The 'department'* may be deceived as to minimum staff and accommodation required.

(*d*) When may a child's name be removed from the Admission Register?

A child's name may not be removed from the Admission Register so long as he is under legal obligation to attend school, unless (α) he is attending another school, or (β) has left the neighbourhood. If he be dead, of course he is neither under legal obligation nor in the neighbourhood.

(*e*) What should be done in the case of a child who is present but fails to answer the roll call?

If a child is present but fails to answer the roll-call, the omission will be discovered when the totals of that school opening are checked. He will then be marked present, and '+ 1' be added by note to the total.

(*f*) If a school opens 425 times in the year, and two half-timers, A and B, attend respectively 212 and 214 times in the year, what is the largest number of additional attendances that may be claimed for each?

When a school opens 425 times, a half-timer can only be credited with 319 (three-quarters of 425) attendances at the most. His credited attendances are further limited to 150 per cent. of his actual attendances. A might therefore claim 318, but B must not reckon 321, but only 319. The additional attendances are therefore 106 and 105 respectively.

(*g*) What is to be done in registration if—

(i) One child, A, goes home without leave at recreation time, and another, B, comes in then, not having been present before?

(ii) A child marked absent is found to have attended a cookery lesson?

i. If A go home without leave at recreation time his attendance must be at once cancelled. If B comes in at recreation time his attendance can nowise be reckoned.

ii. If a child marked absent is found to have attended a cookery lesson, its absence must be cancelled by the mark Ⓒ and '+ 1' be added by note to the total.

2. Draw up an examination paper such as would be suitable to test the knowledge of a pupil teacher at the end of his or her first year.

See any Government tests, or those inserted in our columns.

3. Write notes of a lesson on one of these subjects:—
(*a*) A court of justice;
(*b*) A ship (*for infants*);
(*c*) Rain and snow;
(*d*) The sun.

NOTES OF A LESSON ON THE SUN.

Class—Standards VI. and VII.

Time—40 minutes.

Apparatus — Tellurium, pictures, photographs.

Objects—(1) To impart knowledge. (2) To arouse the imagination. (3) To correct the judgment.

Matter.	*Method.*
I. *Position* — Centre of Solar System.	Work the Tellurium; show diagram of Solar System; tell of ancient erroneous notions.
II. *Distance from earth, etc.*	Varying from 91 to 94 millions of miles; institute comparisons in order to assist the mind to appreciate this immense distance. Distance from Mercury 35, from Neptune 2,746 millions of miles.
III. *Magnitude of Sun.* Diameter 852,000 miles.	More than 1,300,000 times the size of earth, but not 1,300,000 times heavier, only 325,000 times. 700 times greater than all the planets together.
IV. *Constitution of Sun.* An immense solid body, surrounded by gaseous atmosphere.	Compare with earth's atmosphere, contrast with earth's atmosphere. Sun's atmosphere heated most intensely and subject to terrific storms. The sun contains iron, nickel, titanium, etc. Correct ancient erroneous ideas.
V. *Sunspots.* Some always present, some periodic. Feb. 1892, one was 3,360,000,000 miles in area.	Nature of these spots really unknown, Depressions in solar atmosphere, Signs of solar activity, Compare with storms causing earth-spots, Rotation of sun discovered thereby, Connected with magnetic terrestrial disturbances.

4. (*a*) What are the conditions which should be kept in view in forming a good school library? (*b*) Mention the titles of 20 books which you would choose in such a library. (*c*) State what rules you would lay down for its management.

(*a*) The books should be suitable for children above 9 or 10 years of age.

(β) They should consist of simple fiction, biographies, popular science, patriotic works, voyages and travels, and a few books bearing on the subjects taught in school. The fiction should have a human, a moral, a geographical, or historical value.

(γ) The books should not be too expensive, should be printed in large type, be profusely illustrated and well bound.

(δ) In number they ought to be double the average number of the borrowers.

(ε) In size, they should not exceed 300 pp., and each should be 'complete in one volume.'

(*b*) (1) 'The Desert Home.'
(2) 'Tales of a Peasant.'
(3) 'Thirty Thousand Leagues under the Sea.'
(4) 'Ivanhoe.'
(5) 'Robinson Crusoe.'
(6) 'Swiss Family Robinson.'
(7) 'Decisive Battles.'
(8) 'Charles Kingsley's Greek Tales.'
(9) 'The Water-babies.'
(10) 'A Thousand and One Gems of Poetry.'
(11) 'Lamb's Tales from Shakespeare.'
(12) Plays of Shakespeare.'
(13) 'Pilgrim's Progress.'
(14) 'Voyage of the Sunbeam.'
(15) 'Voyage of the Beagle.'
(16) Wallace's 'Travels on the Amazon.'
(17) Smiles' 'Self-help.'
(18) 'Lives of Nelson and Wellington.'
(19) 'The Arabian Nights.'
(20) Cassell's 'Book of Games.'

(*c*) (1) The senior P.T. should be the librarian.
(2) The books must be arranged in sections and numbered.
(3) The head teacher should inspect the library once a quarter and receive report of librarian as to additional books, books worn out, or volumes needing repair.
(4) Books should be taken out and returned at close of Friday afternoon school.
(5) No book should be out longer than a week, but renewal for another week should be permitted.
(6) In case of damage, the offender should replace the work, or be displaced from benefit.
(7) Only one volume per child should be allowed out at once.
(8) Exceptions to rules 4, 5, 7 may be allowed during holidays.
(9) All books must be impounded twice per year, during overhauling of the library.
(10) No one, but the librarian, should have the slightest access to the library.

5. What are (*a*) the advantages, or (*b*) the disadvantages of the plan of calling upon children to put questions to the class at the end of a lesson?

(*a*) *The advantages of children questioning* at the close of a lesson are:—
(1) They are incited to attend during the lesson.
(2) The questioner has to *express* his ideas.
(3) The difficulties present to the child-mind would be elicited by the clever children's questions.
(4) What portions of the lesson had been grasped and appreciated, and what misunderstood or under-estimated, would be evident.

(*b*) *The disadvantages of children questioning* at the close of a lesson are :—

(1) The questions would not form a systematic series, but would err both in defect and excess.

(2) The questions would be too suggestive, or would often lead to guessing or monosyllabic answers.

(3) Advantage of partial or incorrect answers would not be taken.

(4) With a weak teacher discipline might suffer.

(5) A certain amount of time would be wasted.

6. Describe the forms of physical drill which are most appropriate for the boys or girls of the upper division of a school.

The simple forms of *military drill as far as extension motions* are valuable alike to boys and girls. Indeed, except that they should not be so prolonged nor quite so arduous for the latter as for the former, the more the exercises do not distinguish between sex the better.

Drill with dumb-bells and Indian clubs is especially useful, provided that the implements are not too weighty, and that the exercises do not unduly task or neglect any part of the frame. Accompanied by music, the exercises may be rendered very attractive.

7. Say in what way it is possible for an elementary teacher to exercise a useful influence over (*a*) the reading, and (*b*) the conduct of children out of school.

(*a*) *The reading of children out of school* may be guided to a great extent by—

(1) The judicious selection of proper books for the school library.

(2) The tastes implanted by using the school library.

(3) By the teacher's own reading, character, habits of thought, and taste.

(4) By the thorough and attractive character of the Teaching.

Much may be done to incite the children to supplement or continue their school reading if such subjects as history, biography, elementary science, music, etc., are pleasantly handled. If the teacher be patriotic, mathematical, æsthetic, he will be imitated by the scholars to a considerable extent, and the kind of reading indulged in will be greatly affected.

(*b*) *The conduct of children out of school* much more depends upon the home than the Teacher's influence. The latter has but three ways of moulding it—by precept, by example, by reward and punishment.

Right principles of morals and of behaviour can be instilled by formal lessons and by utilising incidents ; but the teacher's own practice of inflexible justice, of obliging conduct, of polite manners, of consideration for the weak, of temperate language and of humanity, will be far more influential.

It is a moot legal point whether a teacher, under any circumstances, is justified in inflicting punishment for outdoor offences. He can, however, award praise and bestow censure ; he can reprove the rude and cruel, and approve the polite and kind.

Moreover, he can insist upon politeness to himself and staff outside the school, which politeness should be punctiliously reciprocated, and can create an *esprit de corps* anxious for the good name of the school.

8. What is meant by a good system of school organisation? Give particulars.

A school is perfectly organised when, having regard to the circumstances, the maximum results are produced with the minimum effort, when all the different parts of the machine work together efficiently without friction, heat, or waste power.

To achieve this result five main points must be regarded :—

(1) The scholars must be properly classified according to attainments and ability.

(2) The classes must be well stationed as regards light, class-rooms, etc.

(3) The curriculum must be suited to the scholars, and the subjects arranged so as to secure a due share of attention, and relief to the scholars through the employment or rest of different faculties.

(4) The teaching staff must be properly distributed, care being taken to give the Head-Teacher time for general supervision and for instructing Pupil-Teachers in teaching, and to afford the latter some opportunity for private study.

(5) The apparatus must be well chosen, copiously purchased, and conveniently accommodated.

The Code requirements as to registration, limits of play and religious instruction must be conveniently met.

With poor premises, scant apparatus, or a minimum staff, good organisation is impossible.

9. Explain, with illustrations, the difference between the contrary and the contradictory of a proposition.

α *Contrariety* is opposition between two universal propositions. Both of these may be false, or only one false.

Contradiction is opposition between a universal and particular proposition (or between two singular propositions). Of contradictories, one is always false and the other true.

β Take the proposition '*All men are just*' (A).
Its *contrary* proposition is '*No man is just*' (E).
Both these propositions are **false**.
Its *contradictory* proposition is '*Some men are unjust*' (O).
This is true.
The contradictory proposition to (E) is '*Some men are just*' (I).
This is true.

γ Take the proposition '*Every man is an animal*' (A). **True.**
Its *contrary* is, '*No man is an animal*' (E). **False.**
Contradictory of (A) is '*Some men are not animals*' (O). **False.**
,, ,, (E) is '*Some men are animals*' (I). **True.**

10. Give, with explanations, some examples of—

(*a*) Categorical and hypothetical propositions ;

(*b*) Distributed middle terms ;

(*c*) Abstraction and generalisation.

(*a*) *Categorical* propositions are simply assertions, as '*Man is mortal.*' *Hypothetical* propositions are assertions under a condition. These latter are of two kinds :—

Conditional, as '*If John is trustworthy, then I will go,*' and

Disjunctive, as '*Either he is dead or alive,*'

In some logics the latter species are not accounted *hypothetical.*

The ancient philosophers attempted to reduce all things to categories, including genera and species, so that what might be predicated about the general could be predicated about any species or sub-species. Thus things, live things, animals, men. Anything true about things, live things, animals, is true of men. *Animals are mortal*, involves that *men are mortal.*

(*b*) In a syllogism the element common to the two premisses is called the Middle Term ; it does not appear in the conclusion. Any term is used *distributively* when it applies to each individual of its class. The middle term in a syllogism must be used at least distributively.

EXAMPLES.—

(1) (*Barbara*). Every *animal* has feeling. *Animal* is distributed in Major but not in Minor.
Every man is an *animal*.
∴ Every man has feeling.

(2) (*Camestres*). Every man is an *animal.* *Animal* is distributed in Minor but not in Major.
No stone is an *animal.*
∴ No stone is a man.

(3) (*Darapti*). Every *animal* has feeling. *Animal* is distributed in both Major and Minor.
Every *animal* has life.
∴ Some living things have life.

(*c*) *Abstraction* is the process of separating, in thought, one or more of the attributes of a thing, and thinking of these attributes apart from the thing or class of whose intension or connotation they form a part or the whole. Thus thinking of *strength* apart from *strong things* is an example.

Generalisation is the formation of a class by the comparison of common properties. Thus we can class *water, mercury, alcohol* as fluids, from their common property of flowing.

11. 'From negative premisses you can infer nothing.' Explain and illustrate this statement.

In *Negative Premisses* both extremes disagree with the middle term, and from two disagreements with the standard of comparison no agreement or difference between the disagreeing terms can be concluded, although it may actually exist.

Examples (1) No man is a stone.
No animal is a stone.
Therefore [Nothing]. The conclusions 'No man is an animal,' and *No animal is a man,*' are obviously false.

2. No man is a stone.
No tree is a stone.
Therefore [Nothing]. The conclusions '*No man is a tree,*' '*No tree is a man,* although true, are not warranted, for the extension or denotation of man, stone, tree, are mutually exclusive.

12. What is meant by apprehension, judgment, and reasoning respectively? Illustrate your answer by reference to school lessons.

(1) *Apprehension* or Conception is the operation by which the mind receives notions or ideas or representations of things in the understanding. *Comparison*, *Generalisation*, and *Abstraction* are all involved with Apprehension as a necessary prelude to *Judgment*.

2. *Judgment* is the affirmation or negation of one idea about another. Expressed in words it is called an *enunciation*, or more frequently a *proposition*.

3. *Reasoning* is the inference of one judgment from several.

4. See answer vii. of First Year.

MR. HERBERT SPENCER ON EDUCATION.

13. Take two of the following statements, and show how Mr. Spencer explains and enforces them :—

(*a*) 'In all the higher arts of construction, some acquaintance with mathematics is indispensable.'

(*b*) 'In the absence of the generalisations of biology and psychology, rational interpretation of social phenomena is impossible.'

(*c*) 'Rule-teaching is now condemned as imparting a merely empirical knowledge—as producing an appearance of understanding without the reality.'

(*a*) Mr. Spencer says that the village carpenter, equally with the builder of a Britannia Bridge, makes hourly reference to the laws of space relation. The surveyor in measuring, the architect in designing, the builder, masons and artisans in executing the work, are all guided by geometrical truths, as also the former in laying his drains.

Similarly railways, canals, harbours, docks, piers, mines are constructed from beginning to end by aid of geometry.

(*b*) Condense as in (*a*) from Spencer pp. 32 and 33.

(*c*) Condense as in (*a*) from Spencer pp. 54 and 55.

14. How does Mr. Spencer seek to show that there was an important difference between the principles and the actual practice of Pestalozzi?

Mr. Spencer writes that Pestalozzi was a man of partial intuitions, who had occasional flashes of insight, rather than a man of systematic thought. He lacked the ability logically to co-ordinate and develop the truths thus laid hold of from time to time. Thus his 'Mother's Manual,' his methods of teaching the 'Mother Tongue' and Geography, are utterly at variance with child-nature and the order of mental development, or they are incomplete, or vitiated by the inevitable influence of the old régime.

15. Reproduce Mr. Spencer's comments on the teaching of Grammar, and on the defects in the method of instruction often employed in schools.

'That intensely stupid custom, the teaching Grammar to children,' vituperates Mr. Spencer. 'Grammar should not be the stepping stone, but the finished instrument. (N.B.—Mixed metaphor here.) Grammar and Syntax are a collection of laws and rules. Rules are gathered from practice; they are the results of induction come by long observation and comparison of facts. They are the science and philosophy of language. In following the process of nature neither individuals nor nations arrive at the science *first*. As Grammar was made after Language, so ought it to be taught after Language' (pp. 55, 56).

'Not recognising the truth that the function of books is supplementary, teachers are eager to give second-hand facts in place of first-hand; and this formal instruction, far too soon commenced, is carried on with but little reference to the laws of mental development. Intellectual progress is of necessity from the concrete to the abstract. But, regardless of this, nearly every subject dealt with is arranged in abnormal order; highly abstract studies, such as grammar, which should come quite late, are begun quite early, definitions and rules being put first instead of being disclosed through the study of instances' (pp. 26, 27).

16. What, according to this author, is the final test by which to judge of any plan for mental cultivation? Give particulars.

'As a final test by which to judge any plan of culture should come the question "Does it create a pleasurable excitement in the pupils?" Under normal conditions healthful action is pleasurable, while action which gives pain is not healthful. The repugnances to this or that study are not innate, but the result of unwise systems. It is true that the higher mental powers of children are indisposed to the exertion required, but these should have no demands made on them until the age when ulterior motives operate, and an indirect but powerful pleasure counterbalances a feebler direct displeasure.'

QUICK'S 'EDUCATIONAL REFORMERS.'

17. What distinction does Mr. Quick draw between Humanists and Realists in education, and how does he exemplify that distinction?

Quick quotes Browning's definition, viz. :—

Humanists are those thinkers on education who wish to educate through the study of the classics—

Realists are they who wish to educate through the study of the works of Nature. Our author proceeds—'If anyone now-a-days speaks of the pleasure with which, as a young man, he read Tacitus, he is understood to mean that he is opposed to the introduction of *modern studies* into the school room.' If on the other hand he extols botany, or regrets that he never learned chemistry, this is taken for an assault on classical instruction.' But we must be on our guard against forcing into language a stronger meaning than is intended; and both the humanist and the realist will say and do much, which if not inconsistent with their main idea, has at least no connection with it.

Quick considers Locke not to be a Humanist, but partly an advocate of utilitarian Realism, and partly a far-off forerunner of the modern 'Developing School.'

18. Give a short summary (*a*) of the principal events in Fröbel's life, and (*b*) of the main principles which he advocated.

(*a*) Friedrich Wilhelm August Fröbel was born at Oberwissbach, a village of the Thuringian Forest, in 1783, and died at Marienthal in 1852. After attending a village school, he was (1797–1799) apprenticed to a forester. Next he attended the university of Jena for a year, and for about four-and-a-half years was engaged in farming, land-surveying, &c., now in one part of Germany and now in another.

From 1807 to 1810 he took part in the celebrated institution of Pestalozzi at Yverdun, and in 1811 entered Göttingen University, whence in 1812 he removed to Berlin. Patriotism induced him in the following year to enlist in Lützow's 'Black Riflemen,' with whom he endured the campaign of 1813. In 1814 Fröbel returned to Berlin and became curator of the Museum of Mineralogy under Professor Weiss. This office he discharged until 1816, when he opened a school at Griesheim, which in a short time he removed to Keilhau. Here he married, formed an educational community, and in 1826 published his great work, *The Education of Man*. Four years later he started a school in Switzerland, which never flourished, owing to religious prejudices. However, removing to Burgdorf, he began under the auspices of the Swiss Government to train teachers, as many as sixty at a time.

Here he invented many of his games and exercises, but becoming impatient of official restraints, he returned to Keilhau in 1837 and opened the first *Kindergarten*. Two years later his wife died. Financial difficulties now killed the Kindergarten. From 1837 to 1840 Fröbel attempted to propagandise, lecturing to the public and to teachers, and explaining his systems in his paper the *Sonntagsblatt*.

The last four years of his life he carried on courses for Teachers at Liebenstein. In 1849 he attracted within the circle of his influence a woman of great intellectual power, the Baroness von Marenholtz-Bülow, who has given us in her *Recollections of Fröbel* the only life-like portrait we possess.

His second marriage took place in July 1851. The next month came Fröbel's death-blow, a decree forbidding any Kindergarten to be established in Prussian dominions.

Nine months after, the great educator died.

This answer has purposely been given beyond the length advisable for examination purposes in order to meet numerous requests.

(*b*) *The main principles advocated by Fröbel were*—

(1) All true education must be founded on religion.

(2) Education should be adapted to the development of the child-mind.

(3) That development must be fostered by suitable exercises.

(4) That development must be through self-activity, living, doing, and conceiving.

(5) The mind must *give out* as well as *take in*.

(6) The restlessness of children must be utilised by employment in agreement with their whole nature.

(7) Children must be elementary natural philosophers.

(8) Intuition is the true basis of knowledge, and

(9) there must be no *dead knowledge*.

19. (*a*) What is meant by 'intuition'?

(*a*) *Intuition* is the mental process by which we become conscious of certain facts without the medium of experience.

In a looser sense it indicates the process by which knowledge is gained directly from the senses, and not as inference from sensation.

(*b*) How has the term been explained and applied to the elucidation of the teacher's art by the French writers quoted in Mr. Quick's book?

(*b*) Mr. Quick used the term as meaning '*direct experience*' (p. 417). JACOTOT attributed his success to the fact that students had learned *entirely by the efforts of their own minds*, and he therefore attached so much importance to '*direct experience*' as to propound the paradox '*All human beings are equally capable of learning.*' Similarly he says, '*Everyone can teach; and moreover, can teach that which he does not know himself.*' Jacotot, however, makes to *teach*=to *cause to learn* from 'direct experience.'

M. BUISSON writes: 'Intuition is just the most natural and the most spontaneous action of human intelligence, the action by which the mind seizes a reality, without effort, hesitation, or medium. It is a '*direct apperception*,' made as it were at a glance. If it has to do with some matter within the province of the senses, they perceive it at once.

If in our teaching we can use it, we shall have gained the best helper in the world, the pupil himself.

Similarly M. JULLIEN says that there are intuitions of the four internal senses—the sense for the true, for the beautiful, for the good, and for the infinite—as well as of the external.

20. 'Pestalozzi points to a *high ideal*, and bids us "measure our modes of education by it."' Explain and amplify this statement.

The quotation is from (p. 383) five lines from end of the Essay. In Pestalozzi's own words 'I consider early physical and intellectual education as merely leading to a *higher aim*, to qualify the human being for the free and full use of all the faculties implanted by the Creator, and to direct all these faculties towards the perfection of the whole being of man, that he may be enabled to act in his peculiar station as an instrument of that All-wise and Almighty Power that has called him into life.'

'Let us not forget,' concludes Quick, 'that if we are practical men we are Christians, and as such the *ideal* set before us is the *highest* of all, "*Be ye perfect*, even *as your Father in heaven is perfect.*"'

IV. PARSING AND ANALYSIS, ETC., FOR ROUTINES.

A.—FIRST YEAR.

(*a*) *First Friday* (Men). 'Coming of Arthur,' Lines 309–321 for Analysis. Parse *Thereat, last, Fixing, akin, Being, own, Daughter, therefore, be, to pass, be, breaking, like, colt.*

(*b*) *First Friday* (Women). 'The Princess,' Canto II., Lines 1 to 12 for Analysis. Parse *us, lilac, each, zoned, when, on, rich, moths, curtseying, know, I, following, that, all, issued, gay.*

(*c*) *Third Monday* (Men). 'Coming of Arthur,' Lines 376 to 387 for Analysis. Parse *fall, wave, each, last, till, gathering, Roaring, was borne, is, sweeping, as.*

(*d*) *Third Monday* (Women). 'The Princess,' Canto III., Lines 1 to 11 for Analysis. Parse *Came, furrowing, all, each, drest, that, parts, while, approached, tinged, glowing, Iris.*

(*e*) *Fourth Monday* (Men). 'The Coming of Arthur,' Lines 446 to 458 for Analysis. Parse *whom, most, Lancelot, bring, away, arrived, saint, before, morn, was married, while, beginners, glorying, him.*

(*f*) *Fourth Monday* (Women). 'The Princess, Canto IV., Lines 1 to 11 for Analysis. Parse *sinks, Sun, if, theirs, be, down, rest, cleft, to, glow-worm, Lamp-lit, Descending, Stirring, fell.*

B.—SECOND YEAR.

(*a*) *First Wednesday* (Men). 'Hamlet,' Act II. Scene ii., Lines 85 to 95 for Analysis. Parse *is ended, madam, to expostulate, should, what, why, were, but, therefore, flourishes, Mad, for, nothing, else, go.*

(*b*) *First Wednesday* (Women). 'Coriolanus,' Act II., Scene i., Lines 210 to 222 for Analysis. Parse *Are spectacled, to see, your, cry, while, Clambering, horsed, all, seld-shown, puff, commit.*

(*c*) *Second Wednesday.* (Men). Paraphrase Lines 5 to 19 of 'Coming of Arthur.'

(*d*) *Second Wednesday* (Women). Paraphrase 'Coriolanus,' Act II., Scene ii., Lines 82 to 94.

(*e*) *Third Monday* (Men). Paraphrase 'Hamlet,' Act II., Scene ii., Lines 471 to 481.

(*f*) *Third Monday* (Women). Paraphrase 'Coriolanus,' Act II., Scene iii., Lines 182–196.

(*g*) *Fourth Monday* (Men). Analyse 'Passing of Arthur,' Lines 9 to 20. Parse *shining, but, not, now, O, me, for, why, all, as, if, had made, to shape, Till, beyond, beautiful.*

(*h*) *Fourth Monday* (Women). Analyse 'Coriolanus,' Act III., Scene i., Lines 101 to 112. Parse *have, be, less, blended, theirs, one, he, 'shall' Than, himself, base, To know, supreme, may.*

V. We have made arrangements, merely to suit our own Readers, and with no desire to interfere with existing agencies, for tuition based upon these articles, routines, and questions by experienced teachers and graduates. Names of intending pupils should be sent to DR. G. BEACH, M.A., *Stanley Mount, Macclesfield.* The fees, *to be paid in advance*, are 1s. 6d. per paper, 2s. 9d. per month, 8s. per quarter, or £1 5s. the course.

SELECTED GOVERNMENT QUESTIONS.

FIRST YEAR CANDIDATES.

FIRST WEEK.

1. Write in Largehand the words '*Alphabetically brought.*'
   ,, Smallhand ,, '*A quick brown fox jumps over a lazy dog.*'

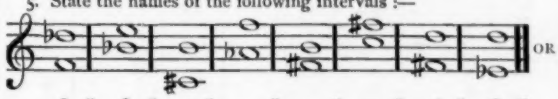
2. Write from Dictation:—

We must not confound the reforming legislator with the jurist and parliamentary draughtsman. It is not inventiveness or originality or technical skill that we honour in those who presided over the transitions of States; it is chiefly the massive courage that moves freely under responsibility. On these principles we estimate the rapid action of this enlightened statesman as an essential element of the reform itself. His promptitude was perhaps rather instructive than calculated, although he must have realised the necessity of justifying, without delay, the exaggerated expectations that were entertained about him.

3. (*a*) What is the difference between voluntary and involuntary attention? (*b*) Show how the faculty of voluntary attention may be strengthened and developed by suitable exercises in a school.

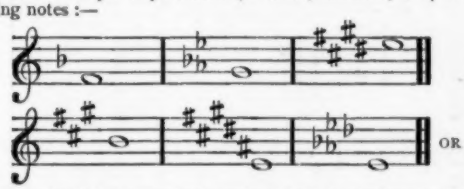
4. (*a*) What purposes has a Teacher in view in teaching Arithmetic? Show what special mental faculties are called into exercise in the study and practice of Arithmetic. Give examples.

5. State the names of the following intervals:—



l ‖ f ‖ s ‖ r ‖ s ‖ m ‖ r' ‖ f
d ‖ t_1 ‖ r ‖ t_1 ‖ f ‖ d ‖ s ‖ l_1

6. State the major key relation (as tonic, mediant, etc.) of the following notes:—



Re-arrange the following notes in order of pitch, placing the lowest note first in each case:—

(*a*) s', d, fe_1, l, t_1, d', s, ta, r f_1, t, r, s, d

(*b*) d, s, r', f_1, fe_1, t_1, ta, m', l_1, s, d', r, f, t, d'

7–10. Parsing, Analysis, and Composition from Routine.

11. Maps from Routine.

12 (*a*) Describe the position of the North and South Poles of the earth with reference to the sun on the 20th day of June.

(*b*) Explain how the inclination of the axis and the movement of the earth cause (1) the lengths of day and night, and (2) the apparent course of the sun in the sky to be different in different places.

13. What is meant by '*The Equatorial Current*'?

14. (*Men.*) What do you know of English Colonisation during the seventeenth century?

(*Women.*) Who were Robert of Gloucester, Arthur of Brittany, Hubert de Burgh, 'The Maid of Norway,' Comyn, The Lords Ordainers?

15. Give some account of the Crusades in which English princes joined.

CERTIFICATE ROUTINE FOR MARCH 1894 (MEN AND WOMEN, FIRST YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Training of the Ear	Read Bacon's Essays, 1, 2, 4, 5, 9, *or* Conclusion of 'The Princess'	Euclid, Book III., Props. 24 to 31, *or* Repairing Underclothing	General Principles of Teaching	Read Bacon's Essays, 11, 14, 15, 16, 17, *or* pp. 1 to 20 of Macaulay's Essay	Euclid, Book III., Props. 32 to 37, *or* Paper Pattern of an Infant's Shirt	Cultivation of the Intelligence	Analysis, etc. *See* Routine	Euclid, Book III., Props. 1 to 7, *or* Any Needlework	Training of the Voice	Analysis, etc. *See* Routine	Euclid, Book II., *or* Organs of Respiration
TUESDAY	Chief Dates from 1641 to 1503	Simultaneous Quadratics, *or* Functions of Food	Geography of all British N. America, *or* Turkey in Asia	Chief Dates from 1503 to 1553	Algebraic Factors, *or* Materials and Cost of Clothing	Causes which affect Climate	Wars with France from 1066 to 1461	L.C.M. and G.C.M. of Algebra — Construction of the Home	Physical Geography of United States *or* China	Chief Dates from 1553 to 1603	Arithmetical and Geometrical Progressions, *or* Composition and Uses of Fresh Air	Distribution of Plants
WEDNESDAY	Compound Interest	History from 1461 to 1503	Drawing	Stocks	Drawing	Mensuration of Polygons, *or* Theory of Interest	Stocks, *or* Simple Proportion	Read Bacon's Essays, 27 to 31, *or* pp. 41 to 61 of Macaulay's Essay	Drawing	Equations of Payments, *or* Stocks	Drawing	Political Geography of Eastern United States, *or* China
THURSDAY	History from 1619 to 1642, *or* Wars with Scotland from 1066 to 1461	Simultaneous Quadratics, *or* Organs of Mastication and Digestion	Map of Western British N. America *or* of China	History from 1503 to 1553	Simultaneous Simple Equations, *or* Care, Cleansing, and Use of Clothing	Effects of Climate on Industry and Productions	Ecclesiastical Affairs from 1066 to 1553	Algebraic Surds, *or* Furnishing of the Home	Map of Nova Scotia and New Brunswick, *or* Hindostan	History from 1553 to 1603	Harmonical Progression, *or* Ventilation	Sequence of Intellectual Development
FRIDAY	Notes of a Writing Lesson to Standard II.	Deductions on Euclid, Book I., *or* Diagram of an Infant's Shirt	Analysis, etc. *See* Routine	Exchange, *or* Theory of Proportion	Read Bacon's Essays, 18, 19, 21, 24, 25, *or* pp. 21 to 40 of Macaulay's Essay	How to Teach Spelling	Present Worth, *or* Simple Proportion	Deductions on Euclid, Book II., *or* Study of Prosody	Write Notes of a Lesson as for Standard VII. upon the lines set for Monday's Analysis	Averages	Deductions on Euclid, Book III., *or* Answering Needlework Questions	Write a Life of Bacon *or* Moore
SATURDAY	Music, Relations as Denoted by Tonic, Dominant, etc.	Science	Examination	Music, Transposition from one Key to another	Science	Examination	Musical Accidentals, *or* Chromatic names	Science	Examination	Musical Terms in Common Use	Science	Examination

CERTIFICATE ROUTINE FOR MARCH 1894 (MEN AND WOMEN, SECOND YEAR).

CERTIFICATE ROUTINE FOR MARCH 1894 (MEN AND WOMEN, SECOND YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Summary Register and How to keep it	Read 'Hamlet,' Act IV., *or* 'Coriolanus,' Act II.	Revise Euclid, Book I., *or* Print Patch	Warming, Colouring, and Lighting of School Premises	Read 'Passing of Arthur,' *or* 'Spenser'	Revise Euclid, Book II., *or* Diagram of a Boy's Shirt	Notes of a Dictation Lesson to Standard VI.	Paraphrasing. *See* Routine	Revise first 20 Props. of Euclid, Book III., *or* Linen Patch	Organisation of Mixed and Half-time Schools	Analysis, etc. *See* Routine	Euclid, Book III., Props. 21 to 37, *or* Any Revision
TUESDAY	Chief Dates from 1399 to 1478, *or* Revision	Insurance	As in First Year, *or* Physical Geography of New Zealand	History as in First Year, *or* From 1558 to 1581	Stocks	As in First Year — Political Geography of New Zealand	Chief Dates from 1478 to 1527, *or* Colonial and Geographical Enterprise in the Tudor Period	Discount	As in First Year — Political Geography of Australia	History as in First Year, *or* Social History from 1558 to 1603	Ratio and Proportion	As in First Year — General Geography of Australia,
WEDNESDAY	Analysis, etc. *See* Routine	Problems leading to Quadratics *or* Choice of Food	Jevons' Logic, pages 7-22	Paraphrasing. *See* Routine	The Health of Scholars and Teachers	Permutations — Food for the Sick	Mensuration of Cylinders *or* Any Revision	Combinations *or* Investments	School Management Code Schedule II.	The Admission Register, and How to keep it	Permutations and Combinations *or* Investments	Revise First Year Music
THURSDAY	As in First Year, *or* History from 1553 to 1558	Stocks	As in First Year — Physical Map of Australia	History from 1553 to 1603, *or* From 1581 to 1603	Race Problems	As in First Year — Physical Geography of Australia	History from 1603 to 1649, *or* Social History from 1485 to 1558	Stocks	As in First Year — Map of Scotland	History from 1649 to 1688, *or* Scotch Affairs from 1485 to 1509	Compound Interest	As in First Year — Commercial Geography
FRIDAY	Problems in Simultaneous Quadratics *or* Beverages for the Sick	Euclid, Book IV., first 10 Props., *or* Diagram of a Boy's Shirt	Formation of Habits and Character	Permutations — Cooking Ordinary Flesh Meat	Euclid, Book IV., *or* Cutting out in Paper of a Boy's Shirt	Mensuration *or* Any Revision	Permutations and Combinations *or* Duties of a Housemaid	Definitions of Euclid, Book V., *or* Diagram of a Child's Muslin Pinafore	Read Bacon's Essays, 1, 2, 4, 5, 9, *or* 'Coriolanus,' Act III.	Surds *or* Economy of Food	Euclid, Book IV. and Definitions of V., *or* Diagram of a Child's Muslin Pinafore	Read Bacon's Essays, 11, 14, 15, 16, 17, *or* 'Spenser'
SATURDAY	Drawing	Science	Examination	Drawing	Science	Examination	Drawing	Science	Examination	Drawing	Science	Examination

16. The hands of a watch are observed to come together at intervals of 65½ minutes true time. Find its rate.
Ans. It loses 1 minute in 24 hours.

17. (*Men.*) Prove
(*a*) If $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=\frac{g}{h}$ that $\frac{a}{b}=\frac{a+c+e+g}{b+d+f+h}$.
(*b*) The L.C.M. of two compound expressions is the product of the expressions divided by their G.C.M.

(*Women.*) What diminution per cent. is made in a man's income when the income tax is raised from 7d. to 9d. in the £?
Ans. $\frac{5}{6}$ per cent.

18. (*Men.*) A hare takes four leaps to a greyhound's three, but two of the greyhound's leaps are equivalent to three of the hare's. The hare has a start of 50 leaps; how many leaps must the greyhound take to catch the hare? Ans. 300.

(*Women.*) (*a*) Draw a diagram on sectional paper of an infant's shirt. Briefly describe how you would make it up.
(*b*) Work on calico not less than two inches of each stitch required in making the garment.

19. (*Men.*) The sides of a triangle are 9, 10, 11. Find the area of the triangle cut off by a line parallel to the largest side and equal to one third of it.
Ans. $\frac{10}{3}\sqrt{2}=4{\cdot}714+$.

(*Women.*) (*a*) Why are fresh vegetables a necessary part of a good diet, especially in summer?
(*b*) Draw up a list of vegetables, mentioning those which are most nutritious.

20. (*Men.*) Write out Euclid III. 7.
With a given point as centre, describe a circle which shall intersect a given circle at the extremities of a given diameter.

(*Women.*) How could you most profitably expend £7 in providing yourself with a complete outfit suitable for the mistress of a country or town school?

21. (*Men.*) Write out Euclid II. 7.
If a straight line AB be divided into any two parts at C, and AC be divided into any two parts at D, the squares on BC, CA, AB are together double of the three rectangles BC, BD, CA, CD, and AB, AD.

For Third Week.

ENGLISH HISTORY.—Male Candidates—First Year.

Answer four of the first six and four of the last six questions.

N.B.—If you answer more than eight questions, only the eight answers coming first on your paper will be revised.

1. Describe the measures, other than military operations, which William I. took to make his Conquest of England secure. What reforms were made by Lanfranc?

2. Name, briefly, the chief events which followed the mediation of Edward I. between the claimants to the Scottish throne, down to the time of his death.

3. Write a short account of the 'Lancastrian Restoration,' from the landing of Warwick in England; and continue it to the death of Henry VI. in the Tower.

4. Enlarge and explain the following statement: 'It was the time of the English Renascence and of the Elizabethan drama. Englishmen now first became great sailors, engaged in foreign trade, and attempted colonisation.'

5. What was Walpole's (*a*) Home, (*b*) Foreign Policy from his accession to office after the 'South Sea Bubble,' to the commencement of the War of the Austrian Succession?

6. What events are connected with Lexington, Arcot, Assaye, Badajoz, Amiens, Vinegar Hill, and Prestonpans? Give a short account of the events which happened at two of them.

7. On what occasions did the Commons impeach the Ministers of the Stuart Kings? Mention the principal charges in each case.

8. 1644 was the critical year of the Civil War. Briefly trace the chief events of the struggle in that year.

9. Give an account of the relations of the Commonwealth with foreign powers.

10. From what cotemporary writers have we an account of the times of Charles I. and Charles II.?

11. Sketch the career of two of the following:—Shaftesbury, Strafford, Robert Cecil, Marlborough.

12. Give a short account of the Home Government of William III.

SECOND YEAR CANDIDATES.

First Week.

1. As in First Year.

2. As in First Year.

3. (*a*) What were Locke's two main characteristics?
(*b*) Show from Locke's own writings that with respect to one of these he was in three respects inconsistent.

4. Locke concerned himself more, as regards education, with its effects upon the future being and doing of the scholar. Comment upon this.

5. Write the signatures of the following keys:—
(*a*) A♭ major. (*b*) B major. (*c*) E♭ major.
(*d*) E minor. (*e*) C♯ minor. (*f*) G minor, or,
Write the names for the following notes:—
(*a*) *ray* flat. (*b*) *lah* sharp. (*c*) *doh* sharp.
(*d*) *me* flat. (*e*) *te* flat. (*f*) *fah* sharp in the minor.

6. See '*question* 5' in First Year.

7–10. Parsing, Analysis, and Paraphrasing from routine.

11. Maps from routine.

12. (*Men.*) As in First Year.

(*Women.*) Describe with statistics the lake systems of the British Isles.

13. (*Men.*) As in First Year.

(*Women.*) Enumerate the political divisions of Australia, giving their approximate area and population, and mentioning three towns in each.

14. (*Men.*) As in First Year.

(*Women.*) Describe the personal character of any two of the Tudor sovereigns. How were any of them allied by marriage to the reigning families of Europe?

15. Give dates of (*a*) Establishment of Court of Star Chamber, (*b*) Battle of Flodden, (*c*) Battle of Pinkie, (*d*) Wyatt's Insurrection, (*e*) Treaty of Cateau Cambresis.

16. (*Men.*) Prove the rule for finding the number of combinations of m things taken r at a time.

(*Women.*) A person who has £3,645 can make £6 a year more by investing it in the four-per-cents at 102½ than in the three-and-a-half per cents. What is the price of the latter stock?
Ans. 93$\frac{8}{9}$.

17. (*Men.*) The number of combinations of m things taken four together is to the number taken two together as 15 is to 2. What is the value of m? Ans. 12.

(*Women.*) If 2 horses be worth 5 oxen, and 3 oxen be worth 16 sheep, what is the value of a horse when a sheep sells for £3 15s.?
Ans. £50.

18. (*Men.*) Find the lateral surface of a cylinder whose diameter is 8 ft. 3 ins., and length 6ft. 8 ins. Ans. 172$\frac{9}{11}$ sq. ft.

(*Women.*) Cut out in paper the right half of a woman's night-dress.

19. (*Men.*) A cylinder whose height is equal to the radius of the base, has a total surface equal to that of a cube whose edge measures 9 inches. Find the height of the cylinder. Ans. 7·219 in.

(*Women.*) What foods do you consider most suitable for (1) young children, (2) working men, and (3) invalids? Give reasons.

20. (*Men.*) (*a*) Write out Euclid IV. 12.
(*b*) Show that in the figure of IV. 10 the circle described round ACD equals that described about ABD.

(*Women.*) When would you do your marketing? How would you choose fish, and how would you know whether meat is fresh and of good quality?

21. (*Men.*) (*a*) Write out Euclid's definition of proportion.
(*b*) Prove Euclid IV. 16.

(*Women.*) What sum of money due a year hence is equivalent to £100 due now, together with £300 due in two years, interest being 5 per cent. per annum? Ans. £391 7s. 11$\frac{3}{11}$d.

For Third Week.

Men.

As for Third Week of First Year.

Women.

1. Write a short account of any three of the following:—Sir T. More, Cranmer, Lady Jane Grey, the Earl of Essex, Cardinal Pole.

2. Give some account of the foreign relations of England in the time of Henry VII.

3. What were the causes of the insurrections in the east and west of England in the reign of Edward VI?

4. What was the cause and what the results of the war with France in the reign of Queen Mary?

5. Mention any instances of the revival of the independence of Parliament in the reigns of Mary and Elizabeth.

6. Who were Elizabeth's chief ministers? Explain how the state of foreign affairs, and the Queen's own character, made their position very difficult.

7. Describe the battle of Flodden, and say what led to the invasion of the Scots at the time.

8. Sketch briefly the condition of Ireland in the reign of Henry VIII.

9. Describe the state of Scotland under the regency of Mary of Guise, and the circumstances under which Mary Queen of Scots came to the throne.

10. The tastes of most of the sovereigns bear evidence to the 'revival of learning in the Tudor period.' Show how far this is true.

CORRESPONDENCE.

We shall be pleased to reply briefly through these columns to any SUBSCRIBER *seeking examinational information or advice, and* ENCLOSING THE NECESSARY COUPON.

This privilege does not, of course, extend to furnishing the solutions and answers of problems. All such communications should be addressed to 'THE QUERY EDITOR.'

Replies demanding urgency will be promptly forwarded per post on the receipt of a stamped and addressed envelope, ACCOMPANIED BY THE REQUISITE COUPON.

A post will be saved by writing direct to DR. GEORGE BEACH, M.A., (Examination Editor of 'Practical Teacher') STANLEY MOUNT, MACCLESFIELD.

G.W.P.K. (Castle).—Try McCarthy's 'History of our own Times.'

C.A.D. (Middleton).—I believe H.M.I. has not the power. The Department would give a definite reply.

—— (——).—You can take one notation for the vocal, and the other for the written.

H.A. (Blackburn).—

$$\frac{17}{5} \div \frac{327}{75} \text{ of } £\frac{109}{40} = \left(\frac{17}{5} \div \frac{327}{75}\right) \times £\frac{109}{40}.$$

The rule is *plus* and *minus* signs separate terms, *multiplication* and *division* signs join terms. It is, however, beginning to be recognised that brackets should be used to prevent ambiguity. The example above is really one term, and should be worked out as the signs are arrived at.

M.E. (Talylarn).—The date of 1895 Scholarship Examination is not fixed. Probably it will be two or three months earlier than usual.

W.H.M. (Rochester) wishes to hear of (1) a small book which teaches the gender of Latin Nouns by means of a suitable adjective joined to each; (2) a book which contains many lists (*e.g.*, Plagues of Egypt, Labours of Hercules) in Latin Hexameters.

S.P. (Newcastle).—An Ex-P.T., having once failed the Scholarship Examination, is not eligible as an assistant between the publication of the result of that examination and the next one.

ANSWERED PER ORDINARY POST.—J.T.W. (Abertilley); W.J. (Middlesborough); A.W. (Earlsdon); B.J. (Macclesfield); E.T.B. (Anderford); E.O.S. (Yarley); H.C.E. (Hartley Witney); M.P. (Forest Gate); A.S. (Simon Road); D.L.S. (Ryde); T.B. (Chesham); A.A.S. (Ulverston); A.L. (Somerset East, Cape Colony); H.W. (Portsmouth); A.F. (Congleton); J.T.B. (Clitheroe); S.S. (Whaley Bridge); A.M.P. (Welwyn); F.C.A. (Hastings); A.B. (Manchester); A.W.D. (Dewsbury); M.T.H. (Crewe); H.W. (Long Buckley); W.W. (Ashton); T.C. (Woodlesford); N.H. (Blundellsands); C.S. (Ripley); W.T.S. (Camborne); T.R.R. (Nottingham); O.A.T. (Upper Kensington); A.C.E. (Greenhithe); E.E. (Greenhithe); K.S. (Halifax); J.W. (Alfreton); B.C. (Birkdale); M.S. (Warrington); W.A. (Portland); K.W. (Chelsea); E.A. (Goole); W.E. (Westoe); A.L.M. (Topsham); N.K. (Tipton); A.A.P. (Sheerness); W.C. (Clitheroe); H.W.B. (Alnwick); W.J.G.C. (Golior); Two Letters, A.E.P. (Bridgenorth); N.M. (Milford); T.B. (Pudsey); W.N. (Frodningham); I.H (Wantage); M.A. (Congleton); J.W.C. (Sheerness); M.A.T.L. (Gare Hill). J.H.M.S. (Castle Northwich); W.H.C. (Cowes); SALE (New Brighton); S.H. (Swansea); F.D.D. (Edinburgh); B.O. (Selly Oak); H.H.S. (Anford); W.W. (Peterborough); G.N.R. (Springdale); J.K. (Ayton); J.E.R. (Newcastle-under-L.); E.O.S. (Peterborough); E.A.R. (Neath); W.H. (Crewe); T.C. (Woodlesford), 2nd Letter; S.V. (Teresco, Isles of Scilly).

LONDON MATRICULATION.

PREPARATION CLASS FOR JANUARY, 1895.

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LATIN.

IN our course this month we are introducing some typical sentences with the Latin version. The notes appended explain the various constructions and idioms that occur. We purpose each month to solve a certain number of sentences in this way, and in addition to this there will be several sentences containing similar idioms, which students can work out for themselves, and compare with our solutions next month.

Latin Course for March.

1. Vergil Aeneid III. 146–293.

2. Grammar: (α) Postgate, §§ 28–42; §§ 105–130; §§ 278–283; and §§ 297–301; or (β) Allen, §§ 20–28; §§ 86–100; §§ 209–239.

3. Translation at Sight: A couple of pieces a week.

4. Bayfield; Exercises 5–24, the second three in each; Exercises 24–80, the third one in each.

Notes on Latin Work.

Supplementary Notes to Page.

147. *Terris*—abl. of 'place where.' In prose the preposition 'in' would be required.

148. Note the gen. pl. *divom.*

150. 'Seemed to stand before my eyes as I lay in sleep'—*iacentis* gen. lit. 'of me lying in sleep.'

152. *fundebat*—'poured.'

153. *affari* and *demere* are Historical infinitives—*his dictis* abl. of means.

154. *delato Ortygiam*—'carried to Ortygia.' Ortygia being a small island, follows the rule that 'motion to' with names of towns and small islands requires the acc. without a preposition.

155. *ultro*—'of his own accord.'

156. *Dardania incensa*' abl. abs. 'when D. was burnt'—do not translate it by the nom. abs. 'D. being burnt.'

160. *ne linque*—ne with the imperative to express a prohibition is poetical, and students should avoid it in their sentences. They should use ne with perf. subjunctive or noli with infinitive.

165. *fama*—'there is a report that'—requires the infinitive (dixisse) after it.

170. *requirat*—'let him seek' jussive subjunctive.

171. *Dictaea*—historical allusion.

176. *e stratis*—'from the couch.'

177. *supinas manus*—'with the palms upwards.'

178. *perfecto honore*—'having finished the offering.' Here the abl. abs. supplies the want of a perf. act. participle.

195. *tenebris*—abl. of cause, lit. 'the wave grew rough through the darkness.' Conington renders it thus—'darkness ruffled the billows' crest.'

198. *Involvere* is here perfect indic. 3 pl., not pres. imp.

204. *pelago*—abl. of 'place where' without a preposition.

211. The scansion should be noted; *ae* is shortened by a Greek idiom.

214. *illis* is abl. after the comparative.

220. *campis*—'in the fields.'

221. *nullo custode*—'with no guardian,' abl. of attendant circumstances.

223. *in partem praedamque* = 'in partem praedae,' 'to a share of the booty'—Hendiadys.

232. *ex diverso caeli*—'from a different quarter of heaven.'

233. *pedibus uncis*—abl. of attendant circumstances—'with hooked talons.'

234. Note the subjunctive *capessant* without *ut*—'I order them to . . '

235. *gerendum* = gerendum esse. Infinitive in oratio obliqua.

240. *aere cavo*—abl. of instrument—'with his hollow brazen trumpet.'

241. Note the inf. *foedare* in apposition to *proelia*.

248. *Laomedontiadae*. Look up the formation of patronymics in the grammar.

249. *patrio regno*—abl. of separation after *pellere*—'from their ancestral kingdom.'

255. the *ante* is to be taken with *quam* in the next line. The separation of the component parts of a word is called 'tmesis.'

257. Distinguish *mālis* here, which is the abl. of *māla*—'a jaw,' from *mālis*, which comes from *mălus* = 'bad.'

258. *pennis*—abl. of instrument.

262. The subjunctives are due to the fact that the sentence is in reported speech (oratio obliqua).

267. *excussosque laxare rudentis*—lit. 'to loosen the uncoiled sheets,' *i.e.*, 'to uncoil and loosen the sheets.' Note how the place of two co-ordinate verbs in Latin is often supplied by a verb and a participle.

275. *nautis* is here dat. of the agent after formidatus, *not* abl., in which case the prep. *a* would be required.

280. *votis*—'with votive offerings.'

292. *portu*—probably old form of dat. for *portui*. 'We approach the Chaonian port.'

Latin Grammar Notes.

The irregular nouns are very important, especially *paterfamilias*, *iusiurandum* (no plural), *vis*, *senex*, *bos*, *Jupiter*, *supellex* (no plural), words of two declensions like *domus*, *iugerum*, *vas* (vasis), &c., words differing in gender in the plural like *locus*, *rastrum*. Defective nouns, and nouns that differ in meaning in sing. and plur., should be learnt. *Nemo* is important. The declension of adjectives should be mastered. In adjectives in *-us* learn a list of those that are declined like *unus* and *alter*, and of those declined like *acer*, noting that *celer* has the genit. pl. *celerum*. Attention should be paid to the endings of the abl. and genit. pl. Note that *plures* and *complures*, different from the other comparatives, have the genit pl. in *-ium*. Note the formation of the comparative and superlative of adjs. and advs., committing to memory the adjs. in *-ilis* compared like *facilis*, the comparison of adjs. ending in *-dicus*, *-ficus*, *-volus*, *-er*, and in *-us* preceded by a vowel. All the irregular comparisons must be learnt, and the methods of forming advs. from adjs.

In the syntax the rules for agreement are important. Note the instances given of agreement according to sense. Note the attraction in the phrase 'my name is Menaechmus.' The sentences given in Allen or Postgate to illustrate the rules should be carefully studied. It would be a good plan for students to enter in a book the English part of these examples, and then try and reproduce the Latin. Students, however, need not imitate the examples in which the relative is attracted into the case of the antecedent, or *vice versâ*. The construction '*urbem quam statuo vestra est*' would be a risky one to send up to the Examiner.

Typical Latin Sentences.

(1) After promising to give the soldiers twenty pecks of corn apiece at twenty sesterces a peck, Cæsar set out from Rome.

Caesar militibus singulis vicenos frumenti modios vicenis sestertiis se daturum pollicitus Roma profectus est.

Notes.—(*a*) The verbal noun after the prepositions after, without, instead of, etc., is not translated by the gerund in Latin. 'After promising' = having promised = *pollicitus*, since *polliceor* being a deponent verb has a perf. part. with an act. meaning—otherwise, if *promitto* were used, you would have to say '*cum Caesar promisisset*.' (*b*) Verbs of promising, threatening, and hoping (when the hope refers to a future event) take the future infin. with the subject expressed; *se* will be used, not *eum*, as it refers to subject of *pollicitus*. (*c*) 'Twenty apiece' and 'a peck' will be expressed by using the distributives with all three—*per modium* will not do. (*d*) Definite price is expressed by abl., indefinite generally by gen. (*e*) Motion from is expressed by the abl. with a prep. except in the case of names of towns and small islands, *domus* and *rus* when the prep. is omitted.

(2) On the same day, being informed by the scouts that the general pitched his camp two miles away from Rome, he proceeded by forced marches to Capua.

Eodem die ab exploratoribus certior factus imperatorem castra duo milia passuum a Roma posuisse, maximis itineribus Capuam contendit.

Notes.—(*a*) 'Time when' is expressed by the abl. without a prep. (*b*) The agent after a passive verb is expressed by the abl. with *ab*, except after Gerundive when dat. is used. (*c*) 'Being informed' is translated by the perf. part. here because the pres. part. in English is often used to denote time antecedent to that of the verb on which it depends, whereas in Latin the pres. part. always denotes simultaneous time. (*d*) A 'that clause' after a verb of saying, thinking, etc., is expressed by the acc. and inf., the subject of the 'that clause' being put in the acc. and the verb in the inf. (*e*) *Mille passus* = 1,000 paces, a mile; *duo milia passuum* = two miles: *mille* in the sing. is an adj.; in the plural it is a noun, and requires the genitive after it. (*f*) Here 'space from' is denoted, *not* 'motion from,' and hence '*a*' is used. (*g*) 'Motion to' expressed by *ad* and acc. except in the case of towns and small islands, *domus* and *rus* when acc. alone is used, hence Capuam.

(3) Cæsar was prevented from forming these plans by the arrival of the enemy.

Hostium adventu Caesar est prohibitus quominus (or *ne*) *haec consilia iniret.*

Notes.—(*a*) The instrument after a passive verb is expressed by the abl. without a prep., hence '*adventu*.' (*b*) Verbs of preventing when followed by '*from*' and a verbal noun in English are followed by *quominus* (or *ne*) and the subjunctive in Latin, *not* by *ab* and the gerund, which the beginner is sure to put, if he does not commit a worse atrocity and use the abl. of the pres. part. (*c*) The tense of the subj. is determined by the sequence of tenses by which, if the principal verb is in a secondary or historic tense, the imperf. or plpf. subj. must be employed—the first to denote present, future, or continuous time, the latter antecedent time to the verb of the principal clause.

(4) The general ought to have ordered the citizens of Rome to threaten these slaves with death.

Imperator civibus Romanis imperare debuit ut his servis mortem minarentur.

Notes.—(*a*) A citizen of Rome must not be translated by '*Civis Romae*,' which means 'a citizen at Rome.' (*b*) The verb *impero*, 'to order,' takes a dat. of the person, while the 'to and the inf.' clause is translated by '*ut*,' and the subj. according to the rule that verbs of asking, commanding, advising, etc., when followed by such a clause, require *ut* and the subj. (N.B.—*Jubeo*, 'to order,' takes acc. and inf.) (*c*) Note the pres. inf. after *debuit*. The verb '*ought*' in English, when referring to past time, takes the perf. inf. after it, as it has no distinct past tense of its own; *debeo* has, and therefore does not require the perf. inf., which in Latin expresses time antecedent to that of the verb on which it depends. (*d*) After *minor* the dat. of the person threatened and the acc. of the thing threatened are used. (*e*) For tense of *minor* see 3 (*c*).

(5) On hearing this, I asked him if he had left Corinth with you.

Hoc audito eum rogavi num Corintho tecum excessisset.

Notes.—(*a*) Here 'hearing' is not to be translated by gerund—'on hearing' = having heard. As Latin verbs have no perf. act. part., its place can be supplied (1) by the abl. abs., using the perf. pass. part., or (2) by *cum* and the plpf. subjunct., which is usual when the phrase is a long one or the verb is intransitive. Here the abl. abs. is used. Lit. 'this having been heard.' (*b*) '*If*' in a question is not translated by '*si*,' but by '*num*.' (*c*) A verb in a dependent interrogative sentence is always in subj. (*d*) The tense of the subj. is decided by the rules in (3) above. (*e*) *Corintho*—no prep. with *Corintho*. See (1) (*e*). (*e*) Note when *cum* is an enclitic, '*mecum*, *secum*,' etc., *not* '*cum me*,' etc.

Sentences, some of which contain constructions similar to above. (A solution will be given next month):—

(1) After threatening the citizens with punishment, he left the city of London with his two brothers.

(2) Who does not know that I prevented him from making war against that race?

(3) We ought to have gone to the camp at Marseilles as soon as possible.

(4) We had asked him when he stopped at Rome.
(5) I should have advised you to make it your aim (*id agere*) to carry out your plans without delay.
(6) After ordering him to put these citizens to death, they advanced to Umbria by forced marches.
(7) How few there are who are willing to help the needy and unfortunate!
(8) Do not prevent your son from condemning such a crime as this.

French Course for March.

1. Five pages of translation a week, with a certain amount of written translation. In doing this, avoid paraphrasing, and translate as literally as is consistent with good English. Students should continue to make a vocabulary of the words they have to look out.

2. Grammar. Fasnacht, from §18 to §25 : §95–§98. As questions are occasionally set on the genders of words, the rules for ascertaining the gender by derivation and termination should be constantly referred to. The rules for the agreement of adjectives (§19) are important. The rules for the formations of the feminine always furnish a question. Note especially how words in *-x*, *-b*, *-c*, *-gu*, *-el*, *-ien*, *-el*, *-eil*, *-ou*, and *-eur*, form their feminine. Note the five adjectives that have two forms for the masculine singular. Note that *vieux* is, according to Littré, often used before a masc. word beginning with a vowel. Note *grec—grecque*, but *turc—turque* (beginners should note the fact that adjs. denoting nationality are not spelt with a capital letter). The list of irregular feminines should be constantly referred to. Remember *pêcheur*, 'a fisherman,' has fem. *pêcheuse*, while *pécheur*, 'a sinner,' has fem. *pécheresse*. The former has a circumflex accent to represent the omission of the Latin *s* (*piscator*), but it can also be remembered by the mnemonic that a fisherman's rod and line form a circumflex accent with one another. The words that (*a*) differ in gender in singular and plural (§97) and (*b*) vary in meaning according to their gender, are very important. The latter are, as a rule, derived from different words, *e.g.*, *somme* f. comes from Lat. *summa*, and *somme* m. comes from Lat. *somnus*. The rules for the agreement of the adjectives used with *gens* form a favourite examination question. Note the rule that certain words when denoting the instrument are fem., and when denoting the agent are masculine, *e.g.*, *aide*, *garde*, etc. The rules for the agreement of compound adjs. (§96) should be known. In §95 will be found words in which the masc. is apparently formed from the fem. *e.g.*, *mulet*, *mule*; *canard*, *cane*. This anomaly is in some cases due to the fact that the original masculine has been dropped, while the diminutive formed from it has taken its place, *e.g.*, *mulet* was originally the diminutive of *mul*. In Professor Darqué's book read what corresponds to the above paragraph.

English Course for March.

(1) Hewitt and Beach, pp. 50–78, or Morris's Outlines, Chapter XII., with Beach's Elements, pp. 44–52.
(2) History from the end of Alfred's reign to the end of the reign of William I.

Notes on English Course for March.

History.—Students should not grow tired and abandon their analysis of history. Without it they will be in want of a sheet anchor. In the analysis they should note down the following points. The Danish Invasions, and their results; the lives and policy of Dunstan, Canute, Godwin, Lanfranc; the origin of Danegelt and Ship Money; the influence of the reign of Edward the Confessor; the respective claims of Harold and William of Normandy, and Edgar Atheling, to the English throne; the battles of Stamford Bridge and Senlac (a plan of the latter battle is sometimes required); the progress, completion, and results of the Norman Conquest, with an account of the various revolts; Hereward the Wake; the Anglo-Saxon Institutions; the divisions of the soil; Folc Land and Bolc Land; Hundreds and Tithings; the different courts of justice; the Hundred Mote; Folc Mote; Shire Mote; Witangemote; Hall Mote; the modes of trial; sac and soc; heriot; wergild; mund; frank pledge; compurgators; division of ranks—thanes, earls, ceorls, aldermen, gesiths; the Feudal System and its peculiar features; difference between the English Feudal System and that in force on the Continent; Feudal Incidents, Aids, Primer Seisin, Fine, Escheat, Wardship, Marriage, Forfeiture, Relief; Tenants in Capite; Tenants Paravail; ceremonies in conferring a fief; the Curfew Bell; Domesday Book; New Forest; the means by which William I. kept down (*a*) the English, (*b*) the Normans.

Grammar.—The matriculation papers at the end of Hewitt and Beach should be constantly referred to, and answers written to some of the questions, which can be corrected by the solutions in matriculation English (Stewart's series).

In the work for March, attention should be paid to the following points:—Definitions and Classifications of Pronouns; the advantages of the use of Pronouns; the Etymology and History of each of the Personal Pronouns, especially the differences in usage between *you*, *ye*, and *thou*, at the present day and in earlier times; the history of *its*, and the old usage of *his*; usages and anomalies of the word 'self'; double possessives; Classification of Demonstratives; origin and history of Relative and Interrogative Pronouns; the use of *as* as a relative; the Etymology and uses of the Indefinite and Distributive Pronouns.

Greek Course for March.

(1) Iliad xxiv. 82–165.—Students should continue making a vocabulary, and parsing all the difficult verbs in the present lesson—words like ἄρτο ἶξεν, etc. The student should make up the difference between a non-thematic and a thematic aorist. The former is one in which the endings, -μην, -σο, -το, etc., are attached to the stem without a connecting vowel, *e.g.*, ἄρ -το, above. The thematic aorists are those in which the endings are joined on by a connecting vowel, as in Attic Greek, ἔλυσ-α-το. Phrases like ἐς Πριάμοιο, like the Latin *Ad Vestae* (*templum*), should be noted. Merry's introduction should be constantly consulted for the Homeric form. There is a good Homeric Dictionary by Authenrieth.

(2) *Grammar.*—The declension and comparison of adjectives. Each paradigm should be known, and examples like it declined. Note that compound adjectives have no distinctive form for the feminine. Note the formation of the comparison, and learn the irregular comparatives.

Beginners in Greek had better get easy Greek exercises by Underhill in Macmillan's series, and do a couple of exercises a week, commencing at Part II.

Translation at sight. Two pieces a week from the Anglice Reddenda.

MATHEMATICS.

Arithmetic Course for March.

Definition of a Vulgar Fraction, and of its terms.
Meaning of Multiplication of Fractions.
Graphical proof (*i.e.* by taking a line to represent a unit) that the terms of a fraction may be multiplied or divided by the same number without altering the value of the fraction.
Proof of the Rule for the Multiplication of Vulgar Fractions.
Ten miscellaneous examples of difficult complex fractions. These should be done very deliberately and carefully, and should be *all right first time.*
N.B.—The so-called *Proofs* of Arithmetical Rules are not true Mathematical Proofs. Without Algebra a true Mathematical Proof of such a rule as that for the Multiplication of Fractions is impossible.

Notes on the February Course.

All the theory of H.C.F. and L.C.M. found in Arithmetical Text Books should be passed over. Such investigations belong only to Algebra.
Note the definitions of the *Numbers.*

1 is an elementary idea,
2 is 1 + 1,
3 is 2 + 1 or 1 + 1 + 1,
4 is 3 + 1 or 1 + 1 + 1,
&c., &c.

From these definitions prove that 3 times 5 is the same as 5 times 3.
To Form a Table of Prime Numbers.—Write down all the numbers as far as it is required to go. Strike out every

second number after 2, every *third* number after 3, every *fifth* number after 5, &c. The numbers remaining will be the *Prime Numbers*. Prove this as an exercise.

To Find the Factors of any Number.—See if it is divisible by any prime numbers, taking them in succession: 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, &c. When you have reached a prime not less than the square root of the given number, you need try no more.

We shall be glad to correct the style of solutions of the following question, if sent to the office of this paper.

If a number which is not square is not divisible by any number less than its square root, show that it is Prime.

Algebra Course for March.

Practice as many examples in Miscellaneous Fractions and Fractional Simple Equations as you have time for. Go deliberately, watch every step, and get them all *right first time*.

Learn the meaning of a Common Factor, and a Common Multiple, and the *Proofs* of the Rules for Finding the H.C.F. and L.C.M.

(N.B.—The Proof of the Rule for the H.C.F. turns wholly on the proposition that every common factor of A and B is also a common factor of $mA + nB$.

The difficult part of the L.C.M. Rule is where it is stated that if m and n have themselves no common factor, then the L.C.M. of mD and nD is mnD.)

Prove that (1) the H.C.F. of two expressions is the L.C.M. of all their common factors, and (2) that the product of the H.C.F. and L.C.M. of two expressions is equal to the product of the expressions themselves.

Notes on the February Course.

The following method of factoring an algebraical expression has now become almost essential. It depends on two important principles. The first is, that if x is a factor of A, then when $x = 0$, $A = 0$; and conversely, if by putting $x = 0$, A also becomes equal to 0, then x is a factor of A. The second may be expressed as follows:—'*If two expressions containing* x *are indentically equal for all values of* x, *then the coefficients of like powers of* x *must be equal.*'

E.g. if

$$x^3 + ax^2 + bx + c = x^3 + px^2 + qx + v$$

for *all values* of x, then $a = p$, $b = q$, and $c = v$.

The method is best shown by its application.

Required the factors of

$$x^3(y-z) + y^3(z-x) + z^3(x-y).$$

Notice that the expression is *Symmetrical*, *Homogeneous*, and of the *Fourth Degree*.

If $x-y = 0$, then $x = y$;

$\therefore$ given expression $= x^3(x-z) + x^3(z-x) + z^3(x-x) = 0$.

$\therefore$ $x-y$ is a factor;

$\therefore$ *by symmetry*, $y-z$ and $z-x$ are also factors.

$\therefore$ expression $= (x-y)(y-z)(z-x)\{F\}$, where F is a factor still undetermined.

Now the three known factors are all of *First Degree*, and given expression is of *Fourth*; $\therefore$ F must be of *First Degree*. Also it must be *symmetrical*, so that coefficients of x, y, and z must be the same.

$\therefore$ expression $= (x-y)(y-z)(z-x)(px + py + pz)$, where p is still unknown.

If the expression on the right were multiplied out, the term of the highest degree in x would be $-px^3y$. (This can be easily found without multiplying out the whole expression.) And the corresponding term in the given expression is x^3y.

$\therefore -px^3y = x^3y$.

$\therefore p = -1$.

$\therefore$ given expression $= -(x-y)(y-z)(z-x)(x+y+z)$.

Examples:

Prove by this method that

$$\left.\begin{array}{l} a^3(b-c) + b^3(c-a) + c^3(a-b) \\ ab(a-b) + bc(b-c) + ca(c-a) \end{array}\right\} = -(a-b)(b-c)(c-a).$$

$$a(b^2-c^2) + b(c^2-a^2) + c(a^2-b^2) = (a-b)(b-c)(c-a).$$

$$(a-b)^3 + (b-c)^3 + (c-a)^3 = 3(a-b)(b-c)(c-a).$$

$$(x+y+z)^3 - x^3 - y^3 - z^3 = 3(x+y)(y+z)(z+x).$$

Euclid Course for March.

Read through the enunciations of Book I., and be sure you know their *order*.

Read Book II. 1 to 7. For these propositions the method of proof adopted by Hamblin Smith is a considerable improvement on Euclid. Even those who are already quite familiar with Euclid will profit by the study of this method.

Make quite sure of the 'corresponding Algebraic Formulæ' given in almost every edition of Euclid now published.

Riders:

(1.) Divide a given straight line into two parts, so that the rectangle contained by them may be (*a*) the least possible, (*b*) equal to a given square.

(2.) Of all parallelograms with equal perimeters show that the square is the greatest.

(3.) The rectangle contained by the sum and difference of two lines is equal to the difference of their squares.

(4.) If AB and AC are the two equal sides of an isosceles triangle, and D is any point in the base, show that the square on AD is less than the square on AB by the rectangle BC, CD.

(5.) State and prove the corresponding theorem when D is on the base produced.

Hints on the February riders:

(1.) Apply I. 8, and then I. 29.

(2.) Triangles ADC and ABC are equal (I. 37); take away the common part AXC.

(3.) Draw MPN and OPQ parallel to AB and CB respectively. Then triangles DPB and APB−DPA = ABD−APD = ACD−APD = DPC = BPC.

$\therefore$ DPB = diff. of BPC and BPA = diff. of NPC and QPA (since BPN = QPB) = one-half diff. of MQ and ON.

(4.) If A, B, and C be angular points, and O a point within, then OA + OB > AB (I. 20), OB + OC > BC, and OC + OA > CA. $\therefore$ by addition, 2(OA+OB+OC) > AB + BC + CA. $\therefore$ OA + OB + OC > ½(AB + BC + CA).

The first part is proved by applying I. 21 in a similar way.

(5.) Let AB be the base and D a point in the base, so that the difference of the squares of AD and BD is equal to the given difference. At D erect a perpendicular. This perpendicular is the required *locus*. For if X be any point on it, the diff. of sqq. of XA and XB = diff. of sqq. of DA + DB (from I. 47); $\therefore$ XAB is a triangle having the required conditions. Therefore *every point on the* perpendicular DX fulfils the required condition, and therefore DX is the required *locus*.

MECHANICS.

Course for March.

Meaning of Acceleration—Test for Uniform Acceleration—How Measured when Uniform—How when Variable.

Proof of the three fundamental formulæ of Kinematics:—

I. $v = u + ft$.

II. $s = ut + \frac{1}{2}ft^2$.

III. $v^2 = u^2 + 2fs$.

Examples on the use of these formulæ.

I. follows directly if the meaning of the measure of an acceleration is properly understood. III. is an algebraic deduction from I. and II. II. is the difficult one, and has been proved in many different ways. Todhunter's method of infinitesimal differences and Magnus's graphical method are both difficult and unsatisfactory. The best way for Matriculation students is the method sanctioned by the illustrious names of Thomson and Tait, and given in the later edition of Magnus, in Loney, Robinson, and several other books, which assumes that the *mean velocity* is $\frac{1}{2}(u + v)$.

Notes on the February Course.

The formulæ printed $D = Vt$ is more usually written $s = Vt$, when s instead of D denotes the distance between the positions of the moving particles at the beginning and the end of the time t.

The relative velocity of two bodies, A and B, is obtained by applying to each a velocity equal and opposite to that possessed by A, and finding the resultant of the two velocities then possessed by B.

The change of velocity of a moving body in a given time, is that velocity which, if compounded with the initial velocity, would give the final velocity as resultant.

Loney's Mechanics is published by the Cambridge University Press and not by the Clarendon Press, as stated last month by mistake.

CHEMISTRY.

Course for March.

Instead of floundering through a long series of reactions, you had better learn first something of the elements you have to deal with. Learn this month the Physical Properties (see course for February), and one method for preparing each separate *element* contained in your course. Try to make yourself familiar also with the constitution of the common salts mentioned last month.

Note particularly the allotropic modifications of oxygen, sulphur, phosphorus, and carbon, and the preparation of each. Note the behaviour of sulphur when heated from 0° to 1,000°, and of the allotropes of carbon, oxygen, and phosphorus when heated strongly.

NOTES AND NOTIONS.

BY RICHARD WADDINGTON.

The question of 'Age and Attendance' or 'Age only' is once more to the fore. It would appear to be a kind of 'Easter egg' that is getting pretty well 'addled.' The most fatal objection to an attendance qualification is the increased clerical work it is said to be certain to impose on the Teachers. Now let us see how far this objection bears inspection. At present the attendances have to be totalled year by year and entered on the schedule. Under the attendance scheme the attendances would still have to be totalled and carried forward into the next year's register. Under a system of Intermittent Inspection there would be no schedules, and therefore no entry on the schedule of the attendances. So far, the labour would be much as at present. By this means of carrying forward, the register in use would always show at a glance the total number of attendances made in the school by every child on the register. Remember, there would be no adding and subtracting to make the school year the Civil Year, as is now the case with the Dunce's Certificate. Thus far, I think, it may be claimed that no extra labour is entailed.

* * * * *

But now we are told that children will apply for these certificates long after the registers in which their attendances are contained have been placed on the shelf. This is very likely to be true. But when the child leaves, the Teacher is required to enter in the Admission Register the date of leaving, and it will not be a very difficult task to place the total attendances made in this school after the date of leaving. To fill up the attendance certificate will but require a reference to the Admission Register. Not by any means more intricate than a reference to the Duplicate Schedules for the standard. At present the Teacher must enter, year by year, the standard in which the child is presented. This will no longer be necessary under the N.U.T. scheme.

I have just been enjoying the annual examination. By way of a gentle stimulant, I received the following on the examination morning:—

'Feb. 12th, 1894.

'Dear Sir,—I beg to inform you that we had to take Mary Jane to doctor on friday when she came from school through letting her stand on form all day and if it turns out serious you will drop in for it. 'Yours truly.'

And immediately a vision of £4,000 standing to the credit of the Legal Defence Fund, with Mr. Organ in wig and gown, subdued my fears. Hearty congratulations, Mr. Organ! May you soon sport 'silk.'

* * * * *

The next London School Board election is likely to be a bitter fight. The Teachers will have more than a passing interest in the contest. The M.B.T.A. intends to run its able secretary, Mr. Gautrey, and I understand Mr. Macnamara is to be a Progressive candidate. Teachers everywhere will agree that the editor of the *Schoolmaster* would be a valuable acquisition to the Board. With Messrs. Gautrey and Macnamara at the Board, in addition to Mr. Horobin, the educational aspect of the Board's policy would receive more attention than at present.

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The special representation of District Unions at Russell Square is to be discussed at the Oxford Conference. In the early days of Unionism it may have been politic to invite special representatives from District Unions, but that necessity has long since passed away. Either District Unions must suffer disfranchisement in the ordinary election to the Executive, or the special representation must be abolished. To give a man two or three votes because he is prepared to pay one-fourteenth of the cost of the first vote for the second or the third is out of joint with the times. One man one vote, and one vote one value, are the guiding principles of the times in the elections to Russell Square. The days of fancy franchises are past and gone.

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We are not quite so unanimous on the question of Intermittent Inspection as we were. Teachers begin to realise that Intermittent Inspection with variable grants will bring worry and uncertainty. The mere introduction of irregular visits without notice will not suffice. It will simply give rein to the 'faddist' and 'crotcheter.' Simultaneously with the introduction of Intermittent Inspection we want—

1. The abolition of variable grants and the substitution of a fixed grant.
2. The entry of the Inspector's criticism in the Log Book at the time of visit.
3. A reasonably easy appeal against the criticism.
4. An Inspectorate chosen because of practical experience in school work.

* * * * *

I want to be rid of the annual visit, but I feel sure that unless the system of doling out sixpennyworths of singing, eighteenpennyworths of moral training, and shillingworths of grammar and geography is simultaneously abolished there is trouble in store for the Teachers. And the Teacher must have the right to immediately challenge any unfair or unjust report. Without such safeguards the last stage will be worse

than the first, and worry and vexation of spirit are sure to fall to the lot of the Teacher in greater abundance than at present.

* * * * *

How many of the Inspectors have been appointed because of practical acquaintance with the primary school? Take the last appointment, that of Mr. Roberts, a man fresh from the University lecture-room. A mere novitiate in the work of the Primary School. What compensation is to be given to the Teachers whose careers are blighted while Mr. Roberts is taught his business? Teachers looked to Mr. Acland to end this 'jobbery,' and it would appear they have looked in vain. Dare Mr. Asquith perpetrate a similar appointment on the miners or factory operatives? Certainly not. And why? Because the miners and factory operatives have votes. Are Teachers less powerful? They may not have as many votes, but what they lack in votes they can more than exceed in influence if they will put their hearts into the work. With Intermittent Inspection within the range of practical educational politics, Teachers cannot afford to ignore such appointments.

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THERE is no reasonable excuse for Mr. Acland. There are many Welsh Teachers of wide experience and University distinction at his command. The sub-inspectorate contains many whose only disqualification is that they have intimate knowledge of schools. How long is fidelity to the Department to go unrewarded? The appointment of Mr. Roberts ought to be drummed into the liberal candidates at the next General Election.

* * * * *

THE appeal to the associations on the question of the establishment of a fund for the improvement of the poorly-paid Teachers has not met with a very hearty response. The old aversion to all things that can be dubbed Trades Unionism has been stronger than the mute appeals of our poorly-paid brothers and sisters. But the question is the nearer solution for the discussion. A powerful union cannot allow its members much longer continue to exist under such conditions. I am not anxious as to the form or nomenclature, so long as the remedy is reasonably efficacious, and I feel sure that the Oxford Conference will decide to do something. Whatever is done will require funds, and Teachers must face this fact at the outset. Slowly but surely the Union is tending to the defence of the individual member, and I am sanguine that the badly-paid members will demand that the Union shall become a living reality in their amelioration.

* * * * *

'ARE you in favour of the Voluntary Schools sharing the educational rate where one exists?' is the query that comes to me from the Voluntary Teachers' Association. I am asked to give a direct answer to the question. So much depends on the unstated conditions, that it is impossible to give the simple answer the Voluntary Teachers' Association desires. As a Voluntary Teacher I feel the disadvantage of being unable to come on the rates. In many cases the Voluntary Schools are being kept on by taking the absent rate out of the Teachers' salaries. A few years ago I was working in a Board School. I am doing as good work to-day as I was then, and very much of the same kind. Why should my work be financially crippled now?

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AND yet, in spite of all these experiences, I could not say 'Yes' without reservation to the query of the Voluntary Teachers' Association. I want to know what conditions are to be imposed to secure the spending of the money received from the rates on the schools. What safeguards are to prevent the rate merely becoming a substitute for the subscription. And what control is to be placed on the one man manager in dealing with the rates? Are we simply to share the existing rate, or is the rate to be increased to meet the increased demands?

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UNLESS the granting of rate-aid is accompanied by a public audit and properly constituted management, the schools will gain little, and the Teachers still less. I believe it is a National improvidence to starve education. No questions of sects and formulæ should be allowed to fetter the education of the rising generation. The increase of the local burdens means educational starvation too often. I prefer increased Imperial aid for all schools. I would leave only the cost of administration on the shoulders of the rate-payer. And demanding proper management and public auditing of accounts, I would give every school sufficient to maintain it efficiently, and I would demand that it should be efficiently maintained. The question of creeds is a small and insignificant matter to the Nation. But the proper education of the masses in rural and urban England ought not to be sacrificed for the sake of a penny on the income-tax. Education is National insurance, and the Nation cannot afford to allow it to be lightly sacrificed.

* * * * *

THE Science and Art Department has without doubt raised its standard in drawing. My school was reduced from Excellent to Good this year. The correspondent wrote asking for the grounds of reduction and the reply said that on revision of the papers 'it is found that, although the total number of marks obtained did not reach the minimum required for the award Excellent, the work is as good, or nearly so, as that of the previous year; and the Department has, therefore, decided to raise the award to Excellent.'

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Now, if this means anything, it means that the standard has been raised, and it is time action was taken to prevent this moving of the standard.

CONVERSATIONAL LESSONS IN CHEMISTRY.

BY THOMAS CARTWRIGHT, B.A., B.SC.(LOND.),
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For particulars of the List of Chemicals and PRACTICAL TEACHER Set of Apparatus for working the experiments referred to in these lessons see numbers for January and February 1893.

LESSON XIII.

Before commencing the real business of this lesson, which is to be the examination of a few common acids, let us say a few concluding words concerning Cl. What can Cl do,

Trixie? It can bleach, sir; and you also said that it can disinfect. Very good; and what is bleaching? Bleaching is making white, sir, just as the dead travellers' bones were whitened in the desert, as we read just now. Yes, I'm glad you noticed that. What is this in my hand, Annie? It is brown calico, sir. Quite so; but give me another name for it. Well, Minnie? It is called unbleached calico, sir; and the white calico that we buy, has that been whitened by Cl, sir? It has, and indeed it is for whitening calico that Cl is so very extensively used. Where, Bob? In and about Manchester, sir. Exactly. Now pray give me your attention for a few minutes. Here is some lime, which has been in a jar into which a current of chlorine was permitted to flow. I place some of it in a basin containing water, and here, in another basin, I have a weak solution of HCl, or any other acid. Observe that as soon as I pour some acid into the first vessel, the odour of Cl becomes apparent. Now, why? The acid, sir, sets free the Cl. Very true. If I place the brown calico in the second vessel, and then in the first, what will happen? You answer, Frank. The Cl set free by the acid will combine with the hydrogen of the water that is in the moist calico, and oxygen will be set free, and as soon as it is freed, it will whiten the brown calico. Yes, I think we can all understand that, and it answers roughly to what is done in actual bleaching. The material to be bleached is soured by being placed in a weak acid solution, and then placed in the chloride of lime, as it is termed, to be bleached. If we then permitted the calico to dry without doing anything else to it, it would soon fall to pieces. Now try and tell me why. Must I assist you? Well, what is it that makes your chemical aprons fall to pieces. Oh, now you all answer. Yes, it is mainly the acids that we use. Now go back to my question, and tell me what acid would destroy the calico? Hydrochloric acid, sir. Right, and how would it get there? Go on, Ernest. It is formed, sir, when the oxygen is liberated, just before the bleaching takes place. Very good; and of course you will see that something has to be done to get rid of this unwelcome substance, as you can wear out your calico quite soon enough without any assistance from any acid, so that to finish off the bleaching this acid must be got rid of. Now, Willie, name in order the three processes that must be gone through in bleaching. First, there is the *souring*, sir, then the *bleaching*, and, lastly, the clearing out of the acid. Well, what have you to say, Laura? Please, sir, is the chloride of lime which mother sometimes uses in washing the same as that used by the calico manufacturer? Of course it is; and he uses it for exactly the same purpose as mother does, viz., to whiten calico with. As to disinfecting, all that we need say is that it has been found to make the air of sick rooms much less stuffy and foul if a saucer containing chloride of lime be placed therein, with a little vinegar poured upon it from time to time. Why vinegar, Charlie? Because it is an acid, sir, and will set free the Cl, just as the HCl did. Very good; and now let us turn to our acids. Fill some gas jars with water, and into each pour a droplet of some one of the acids which you have before you. Now taste. Of course you know beforehand what you have just proved: what was that, James? That acids are *sour*. Now take two test-tubes, and into the first put some HCl and this piece of Zn; into the second some H_2SO_4 and zinc. What do you observe, Annie? A gas is coming off, sir. True; and if you hold your thumb over the mouth of the jar until a sufficient quantity of the gas has collected, I think you will be able to tell me what gas it is. Apply a light now. What does that pop tell you? That we have a mixture of H and air, so that in each case H is given off. True; and supposing what we have proved true of these two acids to be true of all, we may say of them—what, Tom? That they all contain H that can be set free by a metal. And what will they all do to blue litmus? Yes, you all know that. Go on, Frank. They will redden it, sir, as the vinegar does the blue pickle cabbage. That is right; keep in mind the pickle cabbage. Now bring me some chalk, some marble, and some washing soda. Take a test-tube each, any three of you. Place a portion of the acid in each. Well, what can you now say? A gas is coming off in each case. Good. Now here are three beakers containing lime water. Pour the gas—not the liquid, mind—into the lime water. Why do you stare? All that you have to do is to let your test-tubes be not more than half full, and to tilt as much as possible without overturning the liquid. Yes, that is right. Now observe the lime water. It is milky, thus proving that in each case CO_2 has been set free. What set it free, Charlie? The acid did, sir. Very true; and now you must recollect that chalk and soda are carbonates, and that acids can decompose carbonates, and set free the CO_2 which they contain. What a carbonate is we shall see by and by. We can now say four things about acids, and as I want you to bear them well in mind, I will at once write them on the board.

Acids—

(1) are sour,
(2) turn vegetable blues red,
(3) all contain H, which can be displaced by metals,
(4) all can decompose carbonates.

Now, let us take these three acids in detail. Look at this one first. When I tilt the bottle, what does the acid remind you of from the slow way in which it seems to move? It is like oil, sir, and I think it is called oil of vitriol. Yes, you are right; but remember, please, that is an acid, although called an oil. What is the proper name for it, Trixie? It is called sulphuric acid. Yes, here is its chemical formula, from which you see that it contains H, S, and O. (H_2SO_4.) Here are two bottles of the same size, one containing water the other H_2SO_4, which is the heavier of the two? The acid, sir. True, it is nearly twice the weight of water. You know how readily it attacks your clothes, from your aprons, and you will easily understand that it will attack substances, corroding them or eating them away as we generally term it. When we put it into water what happens? Great heat is produced, sir, as I felt just now. Yes, and what does that prove concerning the water and the acid? That they combine together, sir. Exactly; and now we will dismiss sulphuric acid by saying that it is the most important of all acids, as it enables us to prepare a large number of bodies without which we should be very uncomfortable, and which we could not get except by means of H_2SO_4. As an example I will mention Cl, which makes white calico so easy to produce. We get Cl from hydrochloric acid, and the HCl is prepared from common salt by means of H_2SO_4, so that no H_2SO_4 would mean no Cl, and so of a host of other substances, including this other acid, which you will observe is marked nitric acid. What is it made from, Charlie? From nitre, sir? Yes, but was not that rather a lucky guess? Now, what is the common name for nitre? Think of your gunpowder, which contains much of it. Well, Bob, what is it? Saltpetre, sir. True; and now perhaps you can remember that from salt and sulphuric acid we get hydrochloric acid, whilst from saltpetre and sulphuric we get nitric acid. Note the label on this bottle, what does it say? Aqueous solution of hydrochloric acid. Now, what is the state of the acid by itself, Arthur? It is a gas, sir, which, as you have told us, is very soluble in water. True, and just as lime is a convenient carrier of Cl, so water is a good carrier of HCl. Any other difference between this acid and H_2SO_4? Go on, Ernest. From the names of them, sir, I can see that the first contains oxygen, whilst the second has no oxygen. Exactly so again, and you may like to know that most acids contain O, and all such are known as oxy-acids. Now to the next bottle, containing nitric acid (HNO_3). Notice what happens when I pour a few drops on to this glowing charcoal. What do you think is the cause of that brilliant exhibition of sparks? Where have you seen anything like it? Ah, you remember, I see, Annie. Proceed with your tale. We saw that same thing, sir, in our lesson on oxygen when the carbon was burnt in the jar of oxygen. Quite true, and what do you infer from that? Think for a minute. Is it the oxygen from the nitric acid, sir, that causes the carbon to combine with it? It is so. You need not be afraid to say what you think another time; nitric acid easily decomposes, because it contains such a large proportion of oxygen: indeed, that is why nitre is used in the manufacture of gunpowder, for nitre, like its acid, is equally rich in oxygen. Just another little puzzle for you. If we place Zn, or Cu, or other metals in HNO_3, what should come off? Hydrogen, sir. Good; now put your theory to the test. Does H come off? By no means. Suppose I tell you that those brown

fumes that you see are oxides of nitrogen, and that water is also formed, will that help you? No? Well, then, I must explain. HNO_3 does give off H when treated with a metal, but at the same time some of the acid decomposes, and the O which is given off does what, Trixie? Turns the H into water, sir, and the nitrogen into nitrogen oxide. Quite so; and if you will endeavour to remember that nitric acid is rich in oxygen, and easily decomposes, and yields up its O, you can see why it is spoken of as an oxidising agent. It is also highly corrosive, and stands between water and sulphuric acid with respect to weight, being about 1½ times as heavy as the former liquid. As we began with the strongest of all acids, we will finish by dealing with the weakest. Into your flask, fitted with a thistle funnel and leading tube, place some lumps of marble, and pour in some acid. HCl will do upon this marble. What will be produced? Carbon dioxide. Well, now pass the stream of gas into the solution of blue litmus. What do you notice? That the colour changes to purple, and not to red. Yes, the acid is too weak to fully accomplish the change, but still we recognise the acid as an acid, if only a weak one, and we call it carbonic acid. If we replace the H of an acid by a metal, we have a body which is neither acid nor the reverse, namely, alkaline, which body we term a salt or neutral body. From sulphuric acid we get sulphates; hydrochloric, chlorides; nitric, nitrates; carbonic acid, carbonates. This subject shall be taken up more fully in our next lesson.

MODERN EDUCATIONAL REFORMERS.

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No. VII.—DAVID STOW.

The Apostle of the Training System.

Broken-down soldiers, antiquated dames, and uneducated men are no longer looked upon as being peculiarly suited for organising and managing schools, although some small remnant of this pious superstition seems to have weight in the minds of those sage beings on whom rests the responsibility for the appointment of our Drawing Inspectors. In the time of Stow, however, this precious custom extended throughout the realm of schools, and inefficiency on the part of the teacher vied with the lethargy and incapacity of the taught. We can, therefore, believe Stow when he tells us that the master of a certain school met his proposal to question the scholars with the significant, if ungrammatical, remark, that '*Them* fellows can't understand a word.' No single individual has done more than David Stow to make this disgraceful educational chaos and void give place to order and organisation. Who, then, was this reformer who dared to set at defiance the cautious conservative spirit referred to by Pope in the following couplet:—

> 'Be not the first by whom the new is tried,
> Nor yet the last to lay the old aside.'

He was the son of a Paisley burgher, having first seen the light in the town of shawls in the year of grace 1793. To the local grammar school the young Stow mainly owed his education, but 'boon nature' had endowed him with a double portion of large-heartedness and sympathy; and truly, indeed, may it be said of him, that 'to relieve the wretched was his pride.' Destined for a mercantile career, our young hero (and a hero he was in the noblest sense of that much-abused word), in 1811, came to Glasgow to graduate in commerce. Here his sympathetic temperament found ample scope, and he went about amongst the poor doing good in his leisure time. It was his daily custom on his way to business to pass through the Saltmarket, a place where the submerged tenth of Glasgow were wont to congregate, and where vice and misery were paramount. If Stow had learnt like his countryman, Burns, 'to gently scan his brither man,' he was none the less resolved to improve him, and this, too, at the fountain head. Wherefore we find him, in 1816, commencing what he quaintly termed his 'deep-sea fishing.' A room was hired in the Saltmarket, and 28 children, varying in age from 8 to 14, were foregathered therein on Sunday evenings. Most inauspicious was the commencement. The candles were extinguished, and when, the illumination having been re-established, the master sought his whilom scholars, their places knew them no more. Nothing daunted, David sought his flock in the slums of the Saltmarket, and recommenced operations on the succeeding Sabbath. Business took a somewhat different course on this occasion. An enterprising youth having armed his toe with a formidable pin, devoted his energies to the soul-delighting pastime of prodding his neighbour's calves; and as, unfortunately, the said calves were not protected after the fashion of the wily footman, consternation, loudly expressed in groans and screams, was the gratifying result of the action of this ingenious youth. The patience and forbearance of the future trainer turned the front of the prodding hero of the pin, and ere long he became the candle-lighter to the Stow assembly. Finding that his efforts were made of more effect by the six days' example and precept of the Saltmarket, our reformer, in 1826, instituted a day school for 100 scholars, and after an interval of three years another school for the accommodation of children between the ages of 6 and 14 was provided; and provision was also made for the training of a few students who might wish to be initiated into the mysteries of Stow's method. This was the first step towards the 'Training System' which was to become so fruitful of good. To the credit of the Glasgow Educational Society it must be recorded that the inception of this movement towards civilising the Saltmarket slummite, and at the same time towards the training of the teacher, met with their hearty sympathy and support. About this time Wilderspin came to Glasgow, and by his lectures he drew public attention to Stow's work, and so greatly advanced matters. One immediate result of this visit was the commencement of a perambulation of the neighbouring towns with a class of children in order to demonstrate to the inhabitants how excellent was the plan adopted by Stow. So successful were these efforts, that similar schools were established in many localities, and, behold! the leaven began to work. In 1829, Edinburgh was visited, and for three days lectures and class demonstrations were given, and from that time Edinburgh gave in its adherence to the new system. The interest called forth by all this devotion to the cause of intelligent teaching culminated in the establishment of the Normal School for Training Teachers in Dundas Vale, Glasgow, now known to men as the Glasgow Church of Scotland Normal School. The cost of building was

£15,700, of which sum the Government contributed £9,500. The joy of the founder may be gathered from the lament which he had frequently voiced, to the effect that 'the teacher had no model school to look at, far less a Normal Seminary to be trained in.' In 1838 the building was finished, and the schools above spoken of were transferred to it. The number of students accommodated was about 50, and a very modest estimate of the time required for training was taken, three months being the period devoted to this all-important work. Not till 1855 was this time extended to the now usual two years, and this was not made compulsory until the year following the reformer's death, which took place in 1864.

Meantime the 'Disruption' made it compulsory for Stow to quit the Dundas Vale School, and to put it into the possession of the General Assembly of the Church of Scotland. If he left the building behind him he was solaced in his enforced 'flitting' by the company of his 50 students and his 700 children, and ere long the little company had another habitation and home in Cowcaddens, the new institution being known then, as now, as the Glasgow Free Church Normal School. As the presiding genius of this place Stow remained until he passed over to the majority, full of years and of honours.

The theory and the resulting practices which are fully set out in the reformer's work, entitled, 'The Training System of Education'—which book, by the way, has run through a dozen editions—were not arrived at by a flash of inspiration or insight; on the contrary, they were the result of many years' dogged thought and practice, and the sole guide to the feet of the author throughout was his resolute determination to ameliorate the condition of what he termed the 'sinking' or 'sunken' amongst his fellows. He early recognised that only by sending forth a band of labourers thoroughly imbued with his own spirit could the desire of his heart be fulfilled. Hence to develop a good teacher was to him to train a missionary. Wherefore must it be conceded that David Stow, the educational reformer, was like Pestalozzi, a philanthropist of the first water, holding firmly to the faith that through his education lay the salvation of the children of the vicious and depraved.

First and foremost in time was the institution of those criticism lessons with which most of us are familiar, but which were totally unknown before the time of the civiliser of the Saltmarket. His mode of procedure was as follows:—To each four students were given four lessons to prepare, viz., (1) a lesson on a simple object, (2) a reading lesson, (3) a Scripture lesson, and (4) a lesson on a fact or law in science. The lessons having been given, adjournment was made to a lecture-room, and here the usual pulling-to-pieces process was gone through. By means of these lessons it was intended to ensure that the students should speak accurately and well, observe closely, think clearly, and treat each other as gentlemen. The increasing importance which is attached to this practice is sufficient tribute to the acumen of the master-mind which initiated it.

Bible-teaching, as may well be imagined, constituted a most important part of the curriculum of a 'Glasgow' school, and here again must credit be given to that training system which 'cultivates the whole nature of the child, instead of the mere head—the affection and habits as well as the intellect.'

Speaking of Moral Training he says: 'For these purposes, and for resisting and subduing the volcano of moral depravity which was ever active around me, I laid down certain rules for my guidance, which eventually proved successful, the most important of which were:—First, *that I would never strike*, whatever degree of provocation might be given; and secondly, *that I should never expel*, however unruly the children might prove. The various methods to which, upon these principles, I was compelled to resort, in order to obtain attention and maintain discipline, obedience and good order, and, at the same time, control and subdue my rising feelings and indignation at their wayward conduct, led to the working out of the great principle of moral training. These self-restraints compelled me, of course, to use moral and intellectual, instead of physical, means of discipline.' Here the goodness of our reformer's heart warps his judgment and prevents him from seeing that many punishments are much more cruel and heartless than the sometimes necessary corporal one. However—

> 'Whoever thinks a faultless piece to see,
> Thinks what ne'er was, nor is, nor e'er shall be,'

and we shall have occasion to disagree heartily with some of Stow's most cherished opinions, which will cause us to recognise with greater warmth of appreciation the thousand and one excellences which are to be found in the Glasgow System. Put briefly, the main features of this system are:—

(1) *The Grading of Schools.*—Stow recognises three grades—(*a*) infants from 5 to 7, (*b*) juveniles from 7 to 10, and (*c*) seniors from 10 to 13 and upwards.

(2) *The Adoption of Mixed Schools.*—'It is impossible,' was his contention, 'to raise girls intellectually as high without boys as with them; and it is impossible to raise boys morally as high without the presence of girls. The girls morally elevate the boys, and the boys intellectually elevate the girls.'

(3) *The Sympathy of Numbers.*—This, we are told, is the 'oil-spring' of the system. 'Sympathy is a principle of our nature which may be directed to good or evil, and is more or less powerful in proportion to the proximity and concentration of numbers.' There is a power, therefore, in numbers not experienced in individual teaching or training; and the *playground* and the *gallery* conjoined, under proper management and superintendence, afford the most perfect sympathy. The system acts in a right or wrong direction according as the children are or are not properly superintended and trained by the master.

(4) *The teacher was to be a trainer capable of training the whole nature of the child.*—This is the great principle for which all intelligent people will thankfully remember Stow. In season and out of season he argued that education at all worthy of the name is absolutely and entirely impossible without a trained teacher. Hence he was bitterly opposed to the monitorial system of Lancaster. 'Masters,' says he, '*may* be tame and imperfect even under any system; but monitors must be so.' And again, 'Will all the telling or teaching or instruction in the

world enable a person to make a pair of shoes, construct a machine, ride, write, or paint without training, *i.e.*, doing?' And as to infants, 'Infant *teaching* is the most easy thing in the world; infant *training* the most difficult.' Monitors, young and inexperienced, cannot be expected to morally or intellectually *train*, or to analyse or picture out any point of difficulty.

(5) *Oral lessons to children arranged on a gallery are an important part of the system.*—That this kind of teaching has many excellences cannot be gainsaid." As, however, the greater part of the answering was to be simultaneous, it must be remembered that simultaneous answering does not imply simultaneous progress. To hug this fallacy is very common, especially amongst teachers; and a distinct tendency in opposition to simultaneous work can readily be traced in modern educational thought. Furthermore, the classes should not exceed 40 or 50 if the teacher is to have any ken of the progress of the individual scholar.

(6) *Full use is to be made of the playground (Stow's uncovered schoolroom).*—The children are always to be in charge of an adult teacher, who is to carefully watch their actions with the view of bringing them in review for condemnation or praise by the class or school congregated upon the gallery. This principle is excellent, but impracticable to the extent designed by Stow. The teacher could not, without great hardship, be expected to be present during the whole time occupied by the children in play. In addition, this detective work would be exceedingly unpopular both with teachers and children, and would cause the children to be unnaturally restrained. On the contrary, if the teacher shows himself now and again in the playground, and sharply uses his eyes, he will be able to satisfy himself whether grave offences are being committed. Minor offences could well be left to the public opinion of the school. Here, again, Stow was undoubtedly right in principle, but he failed to modify his principle in conformity with the demands of practice. His own words on this point run thus:—'Any case of oppression or dishonesty, or particular act of generosity or disinterestedness, is, on the return to the gallery, taken up by the master and thoroughly investigated, and condemned or applauded before the whole of the scholars, or rather simultaneously with the whole of the scholars, they sitting, in a sense, as judges and jury.'

(7) *Picturing out.*—'Before a child has a thorough understanding of a word or point of a subject, the simple elements of the terms used must be present to the mind's eye; and, under this system, whatever the school exercise may be, sacred, secular, or elementary, picturing out ought uniformly to be adopted, both in the broad outlines and in the minuter points of every lesson.'

'Pestalozzi, we are told, was the first who introduced the use of objects and prints in public education. The training system has added the systematic picturing out in words of every abstract term, figurative word or phrase, by analogy, familiar illustration, questions and ellipses, and simultaneous answers.' Picturing out is inexhaustible, whereas to objects, pictures, and prints and diagrams a limit must be set.

To this it is said in reply, that children can gather the meaning of a phrase or sentence without an acquaintance with each individual word, and that whenever possible, objects should be allowed to tell their own tale. With these limitations the principle above propounded is one that must be conducive to the intellectual advancement of those scholars who are wisely put under its discipline.

(8.) *Simultaneous answering and ellipses were made much use of.*—As above remarked, it is very questionable whether there is any considerable educational value attaching to these practices. It is undoubted that individual work is the great desideratum of to-day, hence the demand for smaller and smaller classes.

(9.) *Great importance was given to the teaching of elementary science.*—The present-day outcry in favour of teaching elementary science, and especially with regard to common objects, is nothing more than an echo of the demand made by Stow, and, did space permit, it might be shown that his conception of the ground to be covered by these lessons was as intelligent and as complete as any of the schemes which have been put forward by my Lords and their satellites. Suffice it to say that with respect both to *what* should be taught, and also as to how it should be taught, the veteran, if now alive, would have little to learn from us of the later generation.

(10.) *Physical education must be attended to both in and out of school.*

(11.) *The phonic system of teaching to read is adhered to.*

If we are constrained to say that Stow overlooked the individual too much, that his simultaneous and elliptical answering were deceptive, and that too little was allowed to the child's own initiative, what praise can be considered too great for the man who took the first step towards the systematic training of the teacher and of the taught, who decried that rote teaching which has been the curse of education, and especially English education, who cried without ceasing for the development of the whole being, and who for many long years was one of those courageous 'voices crying in the wilderness,' who by their importunity and perseverance are the pioneers of all great reforms? Such was David Stow, and we are not surprised to hear the Lord President of his times saying that 'all improvements in education that have of late years appeared worth mentioning, can easily be traced to the Glasgow Normal School.' Even after the lapse of thirty years since the death of our reformer, he is in many respects ahead of those in charge of the educational fortunes of our country. All honour, then, to the wise man of Paisley, who not only saw in which way redemption lay, but laboured devotedly in true reformer's spirit to point out the right way to others.

HONOURS PHYSIOGRAPHY NOTES.

BY R. A. GREGORY, F.R.A.S.,

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AND

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Variation of Eruptive Rocks.

Our Honours Physiography contained very little recent work upon volcanic phenomena. There seems, however, now to be a tendency to resume this branch of discussion. A matter of considerable importance to the student of physiography has recently been treated by Professor Johnston Lavis in *Natural Science* (February 1894). This is, the causes of the difference in mineralogical composition of various eruptive and intrusive rocks. As the student already knows, this composition ranges through wide limits, from the more acid Granites and Rhyolites at the one end to the ultra-basic Peridotites on the other. In the former silica is present sometimes to the extent of 75%, in the latter the proportion may sink to 35%. The bases also differ widely, and may be potash and soda or lime with iron and magnesium through a very wide range of variation. (Vide 'Elementary Physiography,' pp. 182–3.) It would not be difficult to account in one's mind for these differences in composition if one volcano or system of volcanoes persistently erupted one variety of lava, and another another, each after its kind. We need then only suppose a series of isolated sources of eruptive material. But, as a rule, a volcano during its career will emit in turn almost any type of volcanic rock, and the problem of accounting for this versatility at once stares us in the face.

(i.) *The Stratified Magma Theory.*—Attempts have been made in the past to explain the variations in the composition of volcanic products by the hypothesis that in the fluid magma from which they are derived, a process of sorting has gone on similar to the sorting that occurs in an iron foundry. In this the heavy iron separates from the fluid slag because of its great density, and in the same way the denser 'basic' constitutents of the fluid substratum of the earth's crust were supposed to sink down through the lighter acid ones. One might expect, if this theory were correct, that in the history of a volcano outbreaks of the specifically lighter acid lava would precede those of intermediate composition, and that the final phases of eruption would be basic flows. As a matter of fact, one of the *commonest successions of lavas* begins with basic rocks, which are followed by intermediate ones of increasing acidity until acid lavas prevail; then after an interval there is a reversion to basic lavas, with which this 'life cycle' of a volcano completes itself.

The idea of the differences in rock composition being due to the stratification according to density of a great subterranean reservoir of fused rock from which volcanic material is derived, is also combated by the fact that volcanoes closely adjacent will simultaneously erupt lavas of very different composition. Thus in the case of Vulcano, two vents not a mile apart erupt, and have for the last 2,000 years erupted, one an (acid) obsidian lava, the other a dolerite (basic). This and kindred facts has been used as an argument against a belief in the existence of any common fluid source of igneous rocks, but, as we shall see, Dr. Johnston Lavis puts rather a different complexion upon this case by ascribing the difference to alterations of the fluid material lying nearest the vent.

(ii.) *The Crystalline Segregation Theory* differs from the one we have entitled the Stratified Magma Theory chiefly in the explanation of the method of separation, for it is still assumed in this view that there is common source varying in composition with the depth. But the variation is ascribed not to a gravimetric sorting of liquids, but to a process of crystallization in the upper and cooler layers and the sinking down of the crystals to the lower strata. As a consideration weighing against this, Dr. Johnston Lavis points out that it is now known that in many rocks felspar and magnetite or augite separate out at the same time, but no rock is known having a composition approaching that of a re-fused mixture of these two minerals.

(iii.) Another view is called by Dr. Johnston Lavis the *Fusion Mixture Theory.* The idea of any stratification of the original magma is put on one side. The local differences in composition are explained by the supposition that locally masses of overlying rock have been melted into and dissolved by the molten eruptive material. At first the new constituents would be greatly in the majority at the region of fusion, but gradually they would diffuse away into the general magma, and their general proportion fall again at this original locality. Fusions of this kind must undoubtedly have occurred in some cases, as Professor Sollas has demonstrated, in Irish igneous rocks. But it is doubtful if this occurs very extensively, and it certainly will not explain the case of Vulcano cited above.

All the above theories seem to imply an acquiescence in the views of the Rev. O. Fisher that there is a fluid shell beneath the outer crust of the earth. But we may point out that they will also apply more or less to the supposition that volcanoes are fed by local fusions. (Mr. Goodchild's *Augen* on a large scale; *vide* the February Practical Teacher.)

(iv.) *The Osmotic Theory.*—In the study of the denuded bases of ancient extinct volcanoes, it is found, of course, that near the central plug of igneous rock the adjacent strata have been fused or very extensively metamorphosed. In this contact metamorphism it is observed that the metamorphosed rocks have undergone not only a physical but a chemical change—*elements have been introduced and others removed.* Dr. Johnston Lavis, following a suggestion of Mr. J. C. Ward, asserts that there is an exchange of constituents strictly comparable to that occurring in osmose between two fluids.

It will be remembered that, with Dr. Gregory, Dr. Johnston Lavis disposed of the view that the structure called *Eozoon* is a fossil. This was shown by the examination of certain ejected blocks of limestone torn from the throat of Monte Somma. This limestone had acquired silica and the lighter alkalies, and lost lime and magnesia. The molten rock had acquired this lime and magnesia and lost the silica and lighter alkalies (potash and soda). The metamorphosed limestone had assumed the peculiar mineral structure familiar to every student of geology. Now, the point we must particularly notice here is that the molten lava in the funnel of the volcano must therefore have altered from an originally acid composition to a basic one. Imagine an increase of the tension from below and a continuous series of eruptions to begin. At first, the lava flowing out will be that contaminated by long standing in the neck, and basic. As the eruption proceeds this will be followed by an increasingly acid flow.

It is scarcely necessary, however, to imagine an increase of tension. Basic rocks are more fusible than acid. Hence any increase of basicity means an increase in fluidity, and a greater facility of eruption. Moreover, so long as fluid or pasty rock is imprisoned near the surface, water is continually being assimilated from the adjacent rocks, and the upward tension increasing.

We may add a few words to prevent a possible misconception. If we do not admit any extensive reservoir of igneous material, but, with Mr. Goodchild, trace the source of each volcanic system to some colossal *Auge* (Practical Teacher for February), then, of course, it is easy to explain why the rocks erupted in one region differ from another. The problem here discussed is why they differ, from the same vent, at different times.

In the same issue of *Natural Science* is a picturesque description of the volcanic dykes that intersect the rocks along the coast of Jersey, written by Mr. Hornell, a member of the well-known firm of natural history dealers, Sinel & Hornell. Here the dykes consist largely of dolerite, and are commonly softer and always much more cracked and amenable to sub-aërial agency than the mother-rock around. Instead, therefore, of projecting, as is usual with dykes (as figured in the 'Elementary Physiography,' p. 240), they get cut out, forming natural roads to the sea, and deep 'gutters' at right angles to these roads, in which an abundance of shore life is found.

Periodic Movements of the Earth's Crust.

Professor Milne, in *Nature*, calls attention to the reports of observations on this subject which were read before the last meeting of the British Association. It seems that new light will be shed on the vexed question of earthquakes and their causes by these records. Seismology is opening a new field for study which supersedes in interest the violent upheavals known commonly as earthquakes. This is in a periodic tidelike movement of the earth's crust. There is a very slight tilting of the earth's crust every twenty-four hours, which rises to its maximum during the night and sinks again to the level in the day. The cause of this regular change of curvature is not stated, it is only certain that it is too great an effect to be the result of lunar attraction. It is, perhaps, a movement of anticlinals and synclinals, the curves of the earth's surface becoming deeper after the expanding influence of the sun's heat during the day, followed by a return to the normal condition consequent upon their cooling. It will be well, however, to wait for increased observations before any generalization is attempted.

'That the earth is breathing,' says Professor Milne, 'that the tall buildings upon its surface are continually being moved to and fro like the masts of ships upon an ocean, are at present facts which have received but little recognition. Spasmodic movements which ruin cities attract attention for the moment, but when the dead are buried, and the survivors have rebuilt their homes, all is soon forgotten.'

Since it has been found that most of the earthquakes of the Himalaya and Alps are produced by faulting rather than by volcanic explosion, Professor Milne suggests that the bearing of these periodic changes of level upon faulting will finally throw light on the more striking phenomena of earthquakes.

Another class of movements to which he calls attention is the '*tremor storms*,' which now appear to be long flat waves moving across the earth's surface like an ocean swell. The slight, almost imperceptible earthquakes of our own country are movements resulting from violent upheavals occurring at a distance, as groundswells of the ocean felt on our coasts are the result of tropical storms. It is easy to imagine that from the centre of disturbance the wavelike movements radiate outwards in increasing circles, becoming flatter and gentler in their advance until they are imperceptible to the senses, and detected only by the finest seismological instruments.

The Classification of Clouds.

For a long time meteorologists have had the classification of clouds under consideration, and many and various have been the systems proposed to include the numerous forms taken by the vapour of water condensed in our atmosphere. Howard's classification is well known. It recognises three principal varieties of clouds, viz., (1) the *Cirrus*, or mare's-tail cloud; (2) the *Stratus*, or ground fog; (3) the *Cumulus*, or wool-pack cloud. By combinations of these three primary types, we get the *cirro-stratus*, or Noah's Ark cloud, which is almost always a sign of rain; the *cirro-cumulus*, or 'mackerel sky'; the *cumulo-stratus*; and the *cumulo-cirro-stratus*, or *nimbus*, which is 'a cloud, or system of clouds, from which rain is falling.' With the advance of meteorology, however, this classification has been found to be insufficient, as it does not take into consideration some of the more important forms of use in forecasting weather. Several new arrangements have been suggested, but the one that has found the greatest favour in the eyes of meteorologists is the following, drawn up by Messrs. Hildebrandsson and Abercromby, and favourably reported upon at the International Meteorological Conference held at Munich in 1891. This classification includes ten typical forms, and should be known to all Honours students.

High Clouds.

1. Cirrus.
2. Cirro-stratus.
3. Cirro-cumulus.

Clouds of Medium Height.

4. Strato-cirrus.
5. Cumulo-cirrus.

Low Clouds.

6. Strato-cumulus.
7. Cumulus.
8. Cumulo-nimbus.
9. Nimbus.
10. Stratus.

The general shapes of these kinds of clouds are shown in a paper by the Hon. Ralph Abercromby in the *Quarterly Journal of the Royal Meteorological Society* (vol xiii., p. 140).

A work containing a number of reproductions of cloud-photographs has recently been issued by the Vatican Observatory, Rome, and to it Signor Mannucci contributes a paper on the classification of clouds. *Nature*, for February 8, gives four illustrations of the photographs referred to. Signor Mannucci accepts the classification of Hildebrandsson and Abercromby, as set forth in a cloud-atlas prepared by Hildebrandsson, Köppen, and Neumayer. The classification given in the atlas differs slightly from that originally proposed. It recognises ten different species of clouds, but divides these into five different groups instead of three, and changes two or three of the numbers. The first group (A) comprises the highest clouds in our atmosphere; the second group (B) includes clouds at a medium height, and the third (C) low clouds. In the fourth group (D) we have clouds in ascending currents of air; and, finally, (E) contains masses of ground fog. This grouping is tabulated below, the letter *a* being used to distinguish the forms of cloud usually accompanied by fine weather, while *b* shows clouds characteristic of foul weather.

A.

Clouds from medium altitudes up to an average of 9,000 metres.

1. Cirrus (*a*).
2. Cirro-stratus (*b*).
3. Cirro-cumulus.

B.

Clouds having average altitudes from 3,000 to 6,000 metres.

4. Alto-cumulus, or strato-cirrus (*a*).
5. Alto-stratus, or cumulo-cirrus (*b*).

C.

Clouds the bases of which have altitudes from 1,000 to 2,000 metres.

6. Strato-cumulus (*a*).
7. Nimbus (*b*).

D.

Clouds on the summits of ascending columns of air, with bases about 1,400 metres high, and summits from 3,000 to 5,000 metres.

8. Cumulus (*a*).
9. Cumulo-nimbus (*b*).

E.

Ground fog and fog-banks up to about 1,500 metres.

10. Stratus.

The following condensations of Abercromby's own descriptions of the above cloud-forms should be of interest.

Cirrus, a wisp of hairy or feathery cloud, not very common in the trades and near the equator, but very frequent in higher latitudes.

Cirro-stratus, a thin veil of wispy cloud, flatter than pure cirrus, and usually more or less mixed with a light formless haze of ice-dust. Almost unknown in the Tropics, but very common in higher latitudes.

Cirro-cumulus. Fleecy cloud. This is a thin high cloud, more or less in detached masses, with a characteristic structure like lamb's wool. It occurs all over the world, and is common in all latitudes.

Strato-cirrus. A denser and lower form of cirro-stratus, very common in the tropics, and by no means rare in England.

Cumulo-cirrus. Fleecy cloud. This, in form alone, is identical with cirro-cumulus, only a little denser and thicker, and at a lower level. 'Mackerel sky' may be either cirro-cumulus or cumulo-cirrus.

Strato-cumulus. A low-level cloud, too lumpy to be called pure stratus, but not composed of the rounded flat-based masses of true cumulus. This cloud is found all over the world.

Cumulus. Rocky cloud. This, in its pure form, is a detached cloud with a flat base and a rocky top, and must vary from a small nubecule to a mountainous mass; one of the commonest clouds everywhere, but becomes less frequent the further we proceed Polewards.

Cumulus-nimbus. This term should be restricted to the mountainous cumulus which discharges rain in showers and thunderstorms.

Nimbus. This word should be restricted to rain from stratiform clouds, and to all the class of clouds which are formed under a dark canopy of rain cloud, even when it is not possible to see whether the summit of the cloud is flat or rocky.

Stratus. This word is used in a most promiscuous manner by different observers for all sorts of low-level clouds. Some call it pure fog; others apply it to fog when it has lifted off the ground; and others again to a low sheet of low flat uniform cloud. Probably the two latter, which are often indistinguishable, should be called typical stratus.

A correspondent having enquired the names of some books on clouds, we communicated with Mr. J. S. Harding, of the Meteorological Office, who has kindly furnished most of the references in the following list:—

'Essay on the Modifications of Clouds,' by Luke Howard, 1865 (out of print?).

'On the Modifications of Clouds,' by the same, 1803. (*Philosophical Magazine*, vol. 16.)

'Clouds, their Forms and Combinations,' by E. Walton, 1873 (Longmans).

'Sur la Classification des Nuages,' by Dr. Hildebrandsson, Upsala, 1879.

'Instructions in the Use of Meteorological Instruments,' by R. H. Scott (Eyre and Spottiswoode).

'Modern Developments of Cloud Knowledge,' by the Hon. R. Abercromby. (*Journal Scottish Meteorological Society*, 1887.)

'Suggestions for an International Nomenclature of Clouds,' by the same. (*Quarterly Journal of the Royal Meteorological Society*, 1887.)

'Wolkennamen und Wolkenformen,' by K. Singer, Munich, 1891.

'Zur Wolken Photographic,' by A. Riggenbach, Basel, 1891.

'Wolkentafeln,' by K. Singer, Munich, 1892.

'Cloud Atlas,' by Hildebrandsson, Koppen, and Neumayer, Hamburg. (Sold at Meteorological Office; 12s.)

'Classificazione delle Nubi,' by Specola Vaticana, Rome, 1893.

'Modern Meteorology' (Stanford, 1879) contains a good lecture on clouds by the Rev. W. C. Ley.

All the above books, and many others, can be seen at the Meteorological Office, 63, Victoria Street, London, S.W., any day between twelve and two o'clock, by asking permission of the Secretary.

NOTES ON PHYSIOLOGY:

EMBRACING THE SYLLABUS (ADVANCED AND HONOURS STAGES) OF THE SCIENCE AND ART DEPARTMENT.

BY WALKER OVEREND, M.B. (OXON.), B.SC. (LOND.).

51. The semi-digested food, or *chyme*, as it issues into the duodenum after an ordinary meal consisting of meat, fat, and farinacious material, contains :—

1. Gastric juice and some peptone which has escaped absorption.
2. Undissolved *myosin* of flesh, and a portion of the gluten of bread which has escaped the action of the gastric juice.
3. Fat.
4. Some of the sugar which has not been absorbed.
5. Starch, dextrin, mucin, etc.

The idea, however, that proteids are converted into peptones, and absorbed as such into the blood, has been combated by many physiologists. Certainly no peptone can be found in the lymphatics of the mesentery. Only a trace in the blood of the portal vein, and in the general blood it is difficult to say whether any peptone is present at all. An interesting experiment points to the view that in traversing the walls of the living intestine peptones undergo an important change. If an animal be killed during full digestion, and two pieces of intestine be tied in two places, by ligature, and removed, both, of course, contain peptone in abundance. But if one is heated strongly, to destroy its vitality, and the other be kept for a time at the temperature of the body—that is, about 98° Fahrenheit—after a time it is found that the former still contains peptone in abundance, but the latter contains none at all. In the second, where the mucous membrane retained its vitality, the peptone has been destroyed. It is thought, therefore, that the peptone is converted by the mucous membrane into some other proteid (either serum-albumin or a proteid closely allied), and in that form absorbed. And when peptone is diffused through parchment paper against water, the quantity passing through is very small. In fact, although the diffusibility of peptone is certainly much greater than that of the other proteids, still it is very small as compared with that of such bodies as sugar and salt. We must, therefore, put aside the fact of its diffusibility, and admit that the absorption of peptone is a vital act, similar, as we shall see later, to the absorption of fat. It is necessary that peptone should be changed, since, if present in the blood in any quantity, peptone acts as a poison to the nerve centres, inducing collapse, convulsions, and death. If injected into the blood through a vein it is not so harmful, but disappears in about ten minutes, while the blood is found then to be uncoagulable.

52. The question has been discussed as to whether albumin must be peptonised in order to become absorbed. It is found that after injection of a solution of albumin into the rectum that there is evidence of a rapid absorption. Moreover, in very young animals, which are being nourished by the milk of the mother, the constituents of the milk, notably *casein*, may be demonstrated in the lacteals of the mesentery. We must, therefore, admit that it is not absolutely necessary for proteids to be converted into peptone in order to be absorbed.

53. Why does the stomach not digest itself? When animals are killed during digestion, it not infrequently occurs that large portions of the stomach appear softened and are perforated, and this may even be followed by partial digestion of the organs in the vicinity, as the spleen. Professor Schiff, of Geneva, asserted that the stomach was protected by a layer of mucus from the action of its own gastric juice. Others have thought that the protection lay in the thorough permeation of the mucous membrane with blood, which is alkaline, and would neutralise any gastric juice which penetrated deeply. And, indeed, if one of the arteries of the stomach be tied, the area of the stomach supplied by the branch is digested, as if it were a foreign body. If by any means, however, the stomach of an animal be kept soaked in gastric juice, the columnar cells of the mucous membrane swell up, and after a time burst, discharging mucus, which protects the deeper layers. It is by no means uncommon for persons to suffer from ulceration of the stomach (gastric ulcer), and the three factors in its production appear to be (*a*) an increased secretion of HCl, (*b*) a stretching of the wall of the stomach, as when a large amount of liquid is ingested, and (*c*) a condition of cramp or spasm of the pyloric region of the stomach (gastric ulcer occurs generally in the pyloric region and upon the small curvature), which is accompanied by a local constriction of the small blood-vessels.

Fig. 1.—Wall of Ileum of Cat, three times enlarged : *v*, villi ; *a*, mucous membrane ; *s*, submucous coat ; *m*, muscular wall.

54. *Structure of the Small Intestine.*—Here the outer longitudinal layer of the muscular wall is complete but thin. Between it and the inner circular layer of muscle is a plexus of nerves (Auerbach's plexus). The submucous coat contains connective tissue, blood-vessels, and also a plexus of fine nerve-branches. The mucous membrane is thrown into transverse folds—the valvulæ conniventes. Each fold consists of mucous membrane, with a little submucous tissue. These folds cease about the middle of the *ileum*. Over the whole of the mucous membrane of the small intestine fine projections are visible, termed the *villi*, and also minute depressions, termed the glands of Lieberkühn. Separating the mucous membrane from the submucous coat is a fine layer of unstriped muscle, called the muscularis mucosæ, or the muscular layer of the mucous membrane. This layer sends a small muscular slip into each villus. The rest of the mucous membrane is filled up with lymphoid tissue, the meshes of which are crowded with lymph cells. Each villus consists of lymphoid tissue, covered by a single layer of columnar epethelial cells. These cells contain a granular protoplasm, an oval nucleus, and a free border which appears striated. And among the columnar cells appear some which are termed goblet cells. In the axis of the villus is a space called the lymphatic space. This communicates with the lymphatics (lacteals) of the mesentery. Between this and the epithelium outside is a network of blood capillaries. The muscular slip from the muscularis mucosæ surrounds the lymphatic space. The glands of Lieberkühn consist of straight tubes lined by a layer of short cubical cells. These glands secrete the succus intestinalis, or intestinal juice. Small accumulations of lymphoid tissue occur throughout the mucous membrane. They are about the size of a pin's head. They are called the *solitary glands*. At the lower end of the ileum they become aggregated together to form several large lymphoid masses—Peyer's patches. A Peyer's patch consists of about 50 solitary glands arranged close together below the epithelium. Brunner's glands lie in the *submucous* tissue of the *duodenum*. They are small branched tubes lined by cubical cells resembling those of the pyloric glands of the stomach. It is said that they secrete a ferment resembling pepsin, which dissolves fibrin when a little acid is added.

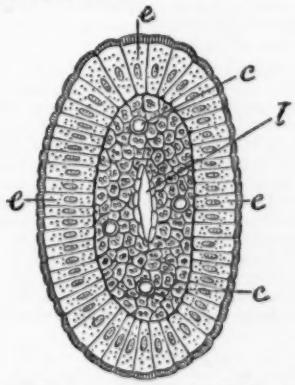


Fig. 2.—Diagram of the Transverse Section of a Villus, very highly magnified : *e*, *e*, *e*, columnar cells ; *c*, *c*, blood capillaries ; *l*, lacteal. The tissue between cells *e*, *e* and the lacteal is lymphoid.

55. *The Pancreas.*—The general structure of the pancreas resembles that of the parotid gland. Like the latter, the pancreas is composed of many microscopic tubes, while the terminal portions (alveoli) contain cells which have specific characters. Every cell shows a clear outer and a granular inner portion, and the outer portion is readily stained by means of carmine or logwood. But the cells vary in appearance with the stage of digestion. After a meal, the inner granular zone diminishes ; in other words, the granules themselves escape into the microscopic tubes to be carried away finally into the duodenum. When the animal is starving, the granules are so numerous that a clear outer portion is scarcely perceptible. In other words, the granules are utilised, and become a

constituent part of the pancreatic juice. After food is taken, the pancreas commences to secrete, and this secretion reaches a maximum in about two hours. The secretion then diminishes up to the 6th hour, when a slight secondary rise in activity occurs, before final cessation. During the early periods, the fluid secreted is very viscid, and coagulates on exposure to air.

56. Pancreatic juice is alkaline, and contains about 5 per cent. solid material. These consist of

(*a*) Albumin.
(*b*) Sodium chloride and carbonate.
(*c*) Three ferments, namely (1) trypsin, (2) a diastatic ferment, (3) a fat-ferment.

One of the best methods of preparing a very active pancreatic juice is to place a pancreas in a dilute solution of rectified spirit for a few days, and then to filter the mixture.

(1) *The diastatic ferment.*—This resembles the ferment of saliva—ptyalin—and like the latter converts starch into dextrin and maltose.

(2) *The fat-ferment.*—If a little olive oil be added in a test tube to some pancreatic juice, and the mixture shaken, the oil becomes emulsified immediately, and resembles milk. The same occurs if butter or mutton-suet be substituted for the oil. The fat in the emulsion exists in a very finely divided state. If the action of the pancreatic fat-ferment be permitted to proceed further, the fat is decomposed into fatty acid, and glycerin, and the fatty acid is then converted into a sodium salt of the acid, by means of the sodium carbonate present in the juice.

(3) *Trypsin.*—When fibrin is added to pancreatic juice, and the mixture kept at the temperature of the body (98·4 Fahrenheit), the fibrin is quickly dissolved. The solution finally contains large quantities of peptone, and also leucin and tyrosin. Unlike pepsin, trypsin is not active in an acid solution, and in acid solutions pepsin will digest and destroy it. In fact, trypsin acts most favourably in an alkaline solution, like a 1 per cent. solution of sodium carbonate. If allowed to stand the fluid becomes putrid. This is due to the activity of certain Bacteria. The action of trypsin on proteids differs from that of pepsin. In the former, the action is more energetic, and a part of the peptone is further split up, and leucin with tyrosin appear. Leucin is a body belonging to the fatty series, and contains an ammonia group. Tyrosin is a derivative of benzene.

57. *The bile* is the secretion of the liver, and its flow is intimately dependent upon the blood supply. When the portal vein is ligatured the secretion stops at once. It is an alkaline fluid containing (1) bile salts, (2) mucin, (3) bile-pigment, (4) fat, (5) cholesterin, (6) salts. The test for the bile salts consists in the addition of a solution of cane sugar and a few drops of strong sulphuric acid. A violet colour is produced if bile salts are present. To recognise the presence of bile-pigment, a little of the solution is placed on a white plate and a few drops of fuming nitric acid added by means of a glass rod. If the bile is orange, a succession of colours follows, first green, then blue, and finally yellow.

58. The liver consists of a multitude of lobules, each about the size of a pin's head, somewhat flask-shaped in reality, and separated from each other by means of the connective-tissue framework of the liver. In section the lobules appear somewhat five-sided, and each lobule is crowded with the liver-cells. Each liver cell is cubical in shape, and contains granules of glycogen and droplets of oil. The arrangement of the capillary network of blood-vessels has been described in my 'Elements of Physiology' (J. Hughes and Co., price 2s. 6d.). Where the sides of the liver cells are in contact, the high powers of the microscope often demonstrate the presence of a minute hole, which is the section of a minute canal—a bile capillary. Every liver cell touches a blood capillary on one side, and each side of the cell is grooved for a bile-capillary. Evidently between the blood and bile-capillaries a portion of the hepatic cell intervenes.

Fig. 3.—Diagram of a Lobule of the Liver, highly magnified: *b*, liver cells; *c*, ending of portal vein in capillaries, *d*, *d*; *a*, central vein of the lobule, which joins with those of other lobules to form one of the hepatic veins.

59. When a small quantity of bile is added to oil, an emulsion is readily produced; just as we have already stated is the case with the fat-ferment of the pancreatic juice. The relative importance of the bile and pancreatic juice in the absorption of fat has repeatedly been the subject of investigation. Many facts may be mentioned which seem to imply that both are engaged in the business. The chyme, as it passes out of the stomach and rushes over the orifice of the common bile duct and pancreatic duct in the duodenum, induces a copious flow of bile and pancreatic juice. The fat-ferment of the pancreatic juice splits up a certain small proportion of the fat into acid and glycerin, and the fatty acid combines with the sodium carbonate to become a sodium salt of the acid, or, as it is called, a soap. Now the presence of soaps always favours the emulsification of fats. When the pancreatic duct is ligatured, and its juice thereby cut off from the intestine, some *chyle* is still found in the lacteals. If, on the other hand, the bile duct is ligatured instead, the absorption of fat is distinctly lessened. We must consider the bile and pancreatic juice as fellow-workers of mutual assistance in the absorption of fat. But their powers are over as soon as a very fine emulsion has been produced. The rest of the affair is a purely vital one. The fat droplets pass in and through the epithelial cells of a villus. This is susceptible of demonstration. For instance, a certain amount of oil is injected into the stomach of a frog. The oil passes on into the intestine after a time. Some hours after the frog is killed, and the mucous membrane is treated with osmic acid, which stains fat droplets of a black colour. When the epithelial cells are then examined under the microscope, they are seen filled with black drops—that is, the particles of oil. We may therefore assume that the epithelial cells of the villi take up the finely divided fat as fat itself, and that little decomposition of the fat occurs within the intestine.

Other substances, as sugar, maltose, etc., readily *diffuse* through the mucous membrane, and entering the capillaries are readily carried away into the portal vein, and reach the general circulation by way of the liver.

60. *Muscular Movements of the Alimentary Canal—Deglutition.*—When the food is sufficiently masticated by the teeth, and mixed with saliva by means of the movements of the cheek and tongue, it is collected on the tongue and thrust backwards into the pharynx. This act is purely voluntary. Arrived at the back of the pharynx, the food is now in a situation common to both the digestive and respiratory systems, and a number of *reflex* movements rapidly occur to prevent any unpleasant effects. In order to prevent the food passing into the nose by the posterior nares, the soft palate is drawn up by muscular action, and at the same moment, if the finger be placed upon the prominence called Adam's apple (it is the thyroid cartilage of the larynx), which exists in the middle line of the neck, the latter is felt to be suddenly raised. As a result of this movement, the epiglottis is depressed over the glottis, and thus shuts off the respiratory passages. In cases of injury to the epiglottis, fluids may go the 'wrong way,' that is, gain entrance into the larynx, and set up coughing. The opening into the nose and trachea being closed, the food must pass into the œsophagus. It is carried down the œsophagus slowly by means of its peristaltic action. With the exception of the first part—the thrusting backwards of the food into the pharynx—deglutition, or swallowing, is entirely a reflex act, and can be performed when a person is in a state of unconsciousness.

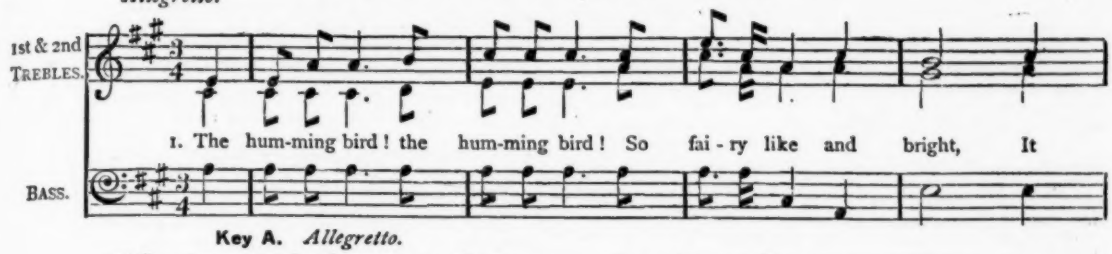
61. *The movements of the stomach* become very active about 15 minutes after food is swallowed. At first the action is to drive the food about, along the great curvature to the pylorus, and back along the lesser curvature, whereby the food and gastric juice become thoroughly and intimately mixed. As digestion proceeds, however, the pylorus relaxes, and then the contraction drives the food through into the duodenum.

62. By the movement of the walls of the *intestine*, called peristalsis, the contents are carried into the large intestine. This movement is readily seen when a rabbit is killed and the abdomen immediately opened.

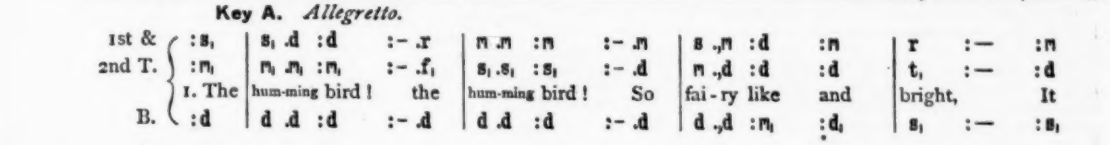
The muscular coat of the intestine consists of an inner circular and an outer longitudinal layer of unstriped muscle, which latter layer in the large intestine is not complete, but the bundles are collected into three longitudinal bands. The circular layer contracting in successive portions produces a narrowing of the tube, which drives the contents onwards—a sort of squeezing action. The action of the longitudinal layer has been compared to the pulling of a stocking over the foot. The normal stimulus which excites peristalsis is the presence of food within the bowel. The intestine possesses two nerve-plexuses, but the relation of these to the movement is obscure. But two nerves pass to the intestine, namely, the vagi and the splanchnics, and seem to regulate its movements; the former increase, and the latter decrease peristalsis.

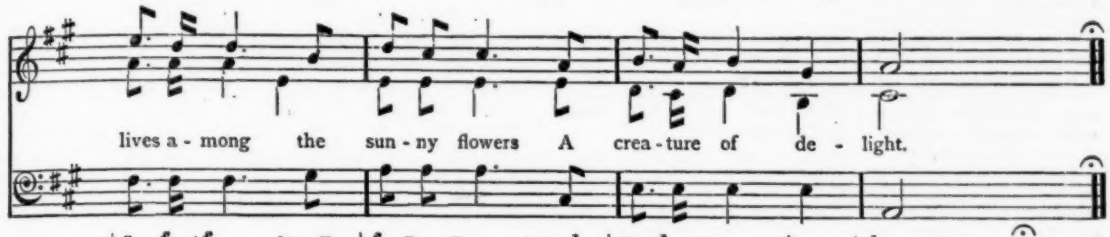
THE HUMMING BIRD.

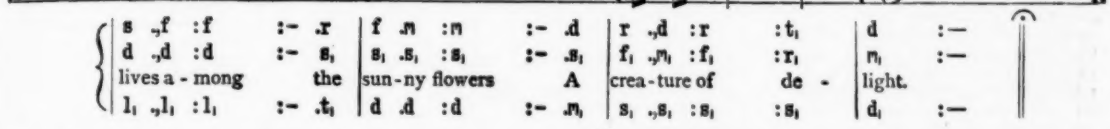
Allegretto.

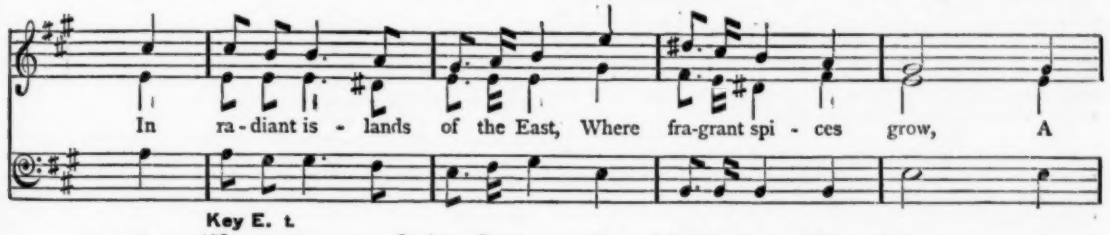


Key A. *Allegretto.*









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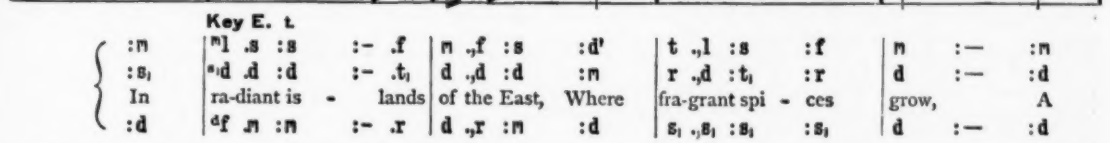

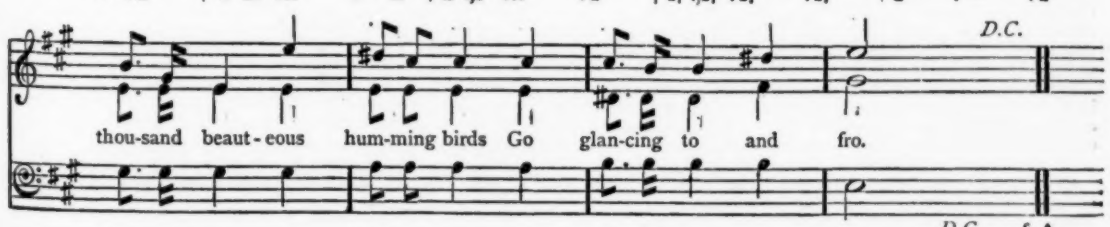

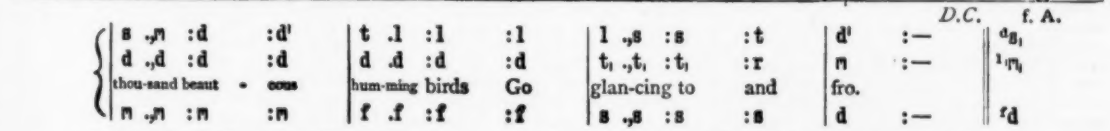

2. Like living fires they flit about,
Scarce larger than a bee,
Among the broad palmetto leaves,
And through the fan-palm tree.
All crimson in her shining breast,
As beauteous as the rose,
Her wing the changeful green and blue
That on the peacock glows.

3. Thou happy, happy humming bird,
No winter round thee lowers,
Thou never sawest a leafless tree,
Nor land without bright flowers.
A reign of summer joyfulness
To thee for life is given,
Thy food the honey from the flowers,
Thy drink the dew from heaven.

63. *Summary of the changes* food undergoes in the stomach and intestines. Arrived in the stomach, the conversion of the starch into maltose by the saliva proceeds for about half an hour, when the acidity of the gastric juice is strong enough to stop it. During this time the gastric mucous membrane has become hyperœmic, and much juice is secreted. The food is gradually converted, by aid also of the muscular movements of the stomach, and the juice, into a soup-like fluid called *chyme*. The proteids are gradually changed into peptones. Connective tissue, which contains material becoming gelatine, also is dissolved. The *fat* is scarcely attacked at all, but its proteid envelopes are dissolved. The rennet ferment acts on milk and clots it (casein). The chyme is from time to time driven through the pylorus; this passage of food into the duodenum does not usually commence for about two hours after food is ingested into the stomach.

The chyme passing into the duodenum induces a copious flow of bile and pancreatic juice. The acidity of the chyme is neutralised, and the bile precipitates some of its proteids. The pancreatic juice converts any untouched starch into maltose; a part of the fats are split up into fatty acids and glycerin, and soaps are produced, and emulsification of the fat is facilitated, the bile, coming into contact with the villi, aids in the absorption of fat. The peptone produced by the pancreatic juice is absorbed rapidly, though a part is converted into leucin and tyrosin.

Fermentative changes induce a decomposition of the carbohydrate and the production of lactic acid, so that by the time the food has reached the large intestine, it is again acid. Very nearly all the fat absorbed takes the path of the lacteals. The water, salts, and sugar, pass readily into the capillary network beneath the epithelial cells of the villi and reach the intestinal veins and the liver.

64. *The spleen* possesses an external coat or capsule, which sends processes inwards into the substance of the gland. These processes unite with each other, and the spaces between are filled with the soft *spleen-pulp*. This pulp is made up of fine fibres, and in its meshes lie the cells of the spleen-pulp, which are (1) large polygonal cells filled with particles of brown pigment or fragments of red corpuscles, (2) normed red corpuscles. The blood after leaving the smaller arteries of the spleen is poured out into the spleen-pulp (there being no capillaries), and is thence taken up by veins. Evidently there must therefore be great resistance to the blood in passing through the interstices of the spleen, and to lessen this it is endowed with the power of contraction. In fact, the spleen may be said to have a pulse of its own, about one beat per minute. The small arteries in passing through the spleen carry small nodules of adenoid tissue—Malpighian bodies—which may be $\frac{1}{50}$ inch in diameter. It is calculated that there are 7,000 in the human spleen.

65. *Functions of the Spleen.*—(1) From the characters of the cells within the spleen-pulp it is obvious that the spleen has something to do with the formation of the blood—either the destruction of used-up, rigid red corpuscles, or the new formation of the same. A series of facts may be quoted in support of both views. It is indeed conceivable that both processes may proceed side by side. It is certain that white blood corpuscles are produced within it, since there is present much adenoid tissue. (2) By virtue of the abundance of unstriped muscle, the spleen suffers variations in volume, which may be recorded on a moving surface. It undergoes a rhythmic contraction and relaxation once every minute. Since these contractions occur after division of all the nerves going to the spleen, they are to be considered as due to the properties of the unstriped muscle itself.

On direct stimulation of the spleen by electric shocks, the muscular fibres contract, and the organ becomes smaller. Certain agents, as the application of cold, and the continued use of the galvanic current, or faradisation, and quinine, reduce its size.

66. *The Suprarenal Capsules* consist of an inner medullary and an outer cortical portion. The medulla appears to be nervous in nature, and to contain many nerve-cells derived from the sympathetic system. From the capsule covering it, fine processes pass inwards, and divide the cortex into columns made up of cells, some of which are crowded with fat granules. The cells of the medulla are large and granular, resembling ganglion cells in appearance. Blood-vessels are numerous. They possess thin walls. Nerves enter the suprarenals from the solar plexus. Certain chemical bodies are found within it, as leucin, benzoic acid, taurocholic acid, etc. Nothing very definite is known of its functions; but when it is diseased, three symptoms are generally present—(1) great debility, (2) pigmentation of the skin, especially of the face, neck, hands, and inside of the cheeks, (3) sickness. The cells of the cortex have been compared with those of the liver, and these are concerned in the alteration and excretion of hæmoglobin. They seem therefore to be concerned in the destruction of the colouring matters of the body. In Addison's disease the red corpuscles refuse to form rouleaux, and the blood clots very imperfectly.

67. The *Thyroid* gland consists of two lobes, with a small isthmus of substance uniting them. The lobes are made up of tubes, which are closed. They are lined by a single layer of cubical cells, and the interior is filled with a layer of clear fluid, or a colloidal mass. Blood-vessels and lymphatics are numerous. After extirpation of the thyroid gland, monkeys become apathetic, the skin of the face and body becomes swollen, owing to the tissues containing a mucin-like substance. In the disease called myxœdema the thyroid gland is usually functionless.

68. The *Thymus* is a mass of lymphoid tissue, crowded with lymph cells. The interior contains also corpuscles with concentric capsules (like starch granules), the functions of which are unknown. The thymus performs the functions of a lymphatic gland. In animals which hybernate, the gland becomes a mass of fat in the autumn season.

SCIENCE NOTES.

NICOTINE AND THE TOBACCO PLANT.—In the course of some recent histochemical researches, Dr. G. B. de Toni finds that the alkaloid nicotine, $C_{10}H_{14}N_2$, is located chiefly in the epidermal tissues of the tobacco plant. It does not seem to be found at all in the seed and the young plant. In the root of the mature plant it occurs in the cortical tissue, and especially in the layer of cells immediately beneath the epidermis. It is almost entirely confined to the epidermal cells in the branches, leaf-stalk, lamina of the leaf, peduncle, calyx, and corolla, occurring especially at the base of the hairs. It is found also in smaller quantities in the anthers and pistil. Nicotine does not appear to exercise any protective function in the economy of the tobacco plant, for both the fresh and the dried leaves are readily devoured by many insects. De Toni regards nicotine as being a simply excretory product, resulting from the reduction of oxygenous substances.

***

FERRATIN.—Ferratin, a substance isolated from pig's liver by Schmiedeberg, contains on the average six per cent. of iron, and is considered to be the only organic iron compound that is present normally in the organs of the animal body, being ingested with food, and stored up in the tissues as a reserve material for the formation of blood. The natural ferratin being difficult to obtain in quantity, the compound is prepared artificially by treating egg albumen, dissolved in water, with the tartrates of potassium and iron together with soda lye. The resulting precipitate is a reddish brown, inodorous and tasteless powder, of neutral reaction, and containing seven per cent. of readily assimilable iron. A sodium compound of ferratin is also prepared which is soluble in water.

***

INDIAN CORN AS A SUGAR PRODUCING PLANT.—The value of maize, or Indian corn, as a sugar-producing plant has been recently investigated under new conditions of growth and development by F. L. Stewart. From the time sugar first shows itself in the cell sap during the early growth of Indian corn until the grain begins to harden, it is found that it steadily increases in quantity. Then it suddenly diminishes and ultimately disappears. On the other hand, if at the critical period the ear of corn be removed promptly, all the energies of the plant are directed to the task of storing up more complex reserve materials in the cells of the stalk, the principal function of which thus becomes the accumulation of sugar. Two valuable crops are thus found to be capable of being secured from the same plant instead of only one, for it is claimed that the immature grain cured by the ensilage system constitutes the best, most nutritive, and most readily preserved form in which it can be used for stock feeding. In addition to this advantage, the method above described increases the sugar yield. The seven to eight per cent. of sucrose contained in the juice at the period when it is ripest, is found to rise to from thirteen to sixteen per cent., a higher proportion than is found in good average samples of either East Indian or Louisiana sugar cane.

***

THE ALEURONE LAYER OF THE SEEDS OF GRASSES.—Mr. P. Groom gives as the result of some experiments recently instituted by him into the composition of the aleurone layer of the seeds of grasses, that these cells contain an abundant supply of oil in the

protoplasmic network, whilst numerous aleurone grains occur in the meshes of the protoplasm, and form the greatest portion of the cell contents. In most cases, however, the grains are found to consist chiefly of globoids with only envelopes of proteid matter. A typical specimen is roughly spherical, and consists of a small proteid shell encasing a large central globoid. Hence, the aleurone layer is a receptacle for phosphates. The proteids of the grains become partially insoluble in water after treatment with alcohol, and in the case of Indian corn, they are not dissolved by a one per cent. potash solution, even after the lapse of twenty-four hours.

***

A NEW GLUCOSIDE.—The dried rhizomes of *Iris florentina* have hitherto been of importance in commerce as furnishing the fragrant orris root of the druggist and perfumer. Laire and Tiedmann have now discovered that they contain a glucoside of peculiar composition and remarkable properties. Iridin, as it is called, was obtained in amorphous white flakes, which on being dried formed a powder. From this powder, on purification and crystallisation from boiling alcohol, fine white needles separated, which became yellow in moist air, and melted at a temperature of 208 C. While iridin is almost insoluble in alcohol, it is more readily dissolved by acetone, and is insoluble in ether, ethyl acetate, benzene, and chloroform. Hot alcohol, however, dissolves it readily, and chloroform precipitates from its solution in acetone. At ordinary temperatures, dilute mineral acids do not attack it, and by the action of aqueous alkaline solutions deep yellow solutions result, from which, after a short time, the unchanged substance can no longer be separated by acids. At 80° to 100° C. iridin is decomposed by dilute alcoholic sulphuric acid, a crystalline substance called irigenin being formed. This body is said to have the properties of a phenol, very dilute alcoholic solutions being coloured deep violet by ferric chloride. Alkalies dissolve it with rapid decomposition, and from these solutions, after a short time, acids throw down an amorphous precipitate only. Irigenin contains two hydrogen atoms, easily replaceable by acetyles.

***

HOME STERILISATION OF WATER.—A simple and fairly effective method of sterilising water is being extensively employed in the Leeward Islands for domestic purposes. To hard water sufficient neutral ferric chloride solution is added to form a perceptible precipitate. In the case of soft water, a small quantity of lime water or dilute sodium carbonate solution is added after the ferric chloride solution, thus causing a precipitate to form. Vigorous stirring in both cases promotes the granulation and subsidence of the precipitate, and after it has subsided the clear water may be drawn off ready for use. For drinking purposes small quantities of water may be subsequently passed through a simple form of filter, such as a felt bag or clean sand in a shallow box or flower-pot. A hundred gallons of water may be purified by the addition of one to one-and-a-half fluid ounces of neutral ferric chloride solution, and if sufficient for a day's supply be treated at night, the pure water will be ready for use in the morning.

***

A NEW SERIES OF NITRO-METALS.—MM. Sabatier and Senderens describe a new series of compounds which they distinguish by the name of nitro-metals, *métaux nitrés*. They are formed by the direct union of nitrogen peroxide with certain metals,—copper, cobalt, nickel, and iron. The metals in a finely divided state, obtained by the reduction of their oxides by hydrogen or carbonic oxide, have the vapour passed over them at a temperature of from 25° to 30°. Nitro-cobalt occurs as a black powder, which reacts violently with water, and when mixed with a combustible substance constitutes a dangerous explosive. Nitro-nickel resembles nitro-cobalt in its properties, while nitro-iron is difficult to isolate, and has not yet been obtained in sufficient quantities for detailed examination. Nitro-copper is a brown substance which reacts with great energy with water, nitric acid being evolved. It contains about 74 per cent. of copper. Nitro-copper is unaffected by dry air at the ordinary temperature, but is dissociated when heated in pure nitrogen. Carbonic oxide reduces the copper to the metallic state on heating; while dry ammonia gas and sulphuretted hydrogen react without the aid of heat. In the first case, metallic copper and ammoniated oxide of copper result. In the latter case, water and sulphur are liberated, and a blue sulphide of copper finally remains.

J. R. G.

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RULES.

1. All communications must be addressed 'Legal Editor, PRACTICAL TEACHER, Froebel House, St. Andrew's Hill, Doctors' Commons, E.C.,' and must be accompanied by our 'coupon,' duly filled up.
2. Replies will be given *only* in this column, except under the conditions named in Rule 3.
3. If any reader desires a reply by post, such can be forwarded by enclosing, in addition to the coupon, a stamped addressed envelope and either stamps or a Postal Order to the value of one shilling.
4. No original documents should be forwarded, but copies only. We cannot hold ourselves responsible for any losses which occur through non-observance of this rule.

'PUZZLED.'—Your difficulty arises from the fact that parishes are divided into three classes:—(1) The complete parish, for all purposes both civil and ecclesiastical. (2) The mere civil parish, without any church, &c.—and which is defined by statute to be 'a place for which a separate poor rate is or can be made' (52 & 53 Vict. c. 63, sec. 6). (3) The mere ecclesiastical parish, which has been defined as 'that circuit of ground which is committed to the care of one parson or vicar, or other minister having permanent cure of souls therein.'

'CÆSAR.'—Yes, you may omit to take these subjects, and may take instead of each of them either a language or a science.

'CONTINUATION.'—Your letter gives me no particulars upon which I can form an opinion. You may have written before, but as *all letters are destroyed* directly the reply is written, no mode of reference exists.

'S.M.S.'—(1) You can obtain the syllabus from the 'Science and Art Directory,' which will be forwarded on application to the Secretary, Science and Art Department, South Kensington, S.W. The price is 6d. (2) The maps required at the scholarship examination are selected from those required for the various examinations for Pupil Teachers.

'M.T.'—You must read and recite at the annual inspection of your school next preceding the date of the Certificate Examination.

'S.J.'—The new syllabus issued since I wrote the reply to which you refer contains a condition which states that 'candidates obtain marks for success at the examination open to them next preceding their Certificate Examination.'

'CONSTANT READER.'—(1) Yes, if obtained at the May Examination next preceding the Certificate Examination. (2) You will obtain no marks for sciences obtained at previous examinations. (3) Yes, Welsh is included in the list of languages for which marks may be obtained.

'C.R.'—Pleased to receive your letter of thanks.

'EX-WY-ZED.'—(1) Write to 'Manager, 4, St. Andrew's Hill, Doctors' Commons, E.C.'; he will be

happy to supply the information. (2) Yes, certainly. Many successful candidates possess none of the qualifications named.

'HALL MARK.'—An ordinary piece of English plate has the following marks:—(1) That of the maker, which must be the first letter of his Christian and surname. (2) That of the Goldsmith's Company, the Leopard's Head. Note.—*This is in London only. There are six Assay Offices out of London, each of which use a different mark from the Leopard's Head. The Birmingham Office, for instance, uses an Anchor, and the Dublin Office a Crowned Harp.* (3) The Sovereign's mark, a lion passant. (4) A letter denoting the year in which the plate is made. For this year the Goldsmiths' letter is 'S.' Plate is Hall-marked when below the standard of sterling gold or silver, and the degree of fineness is marked on the article. As low as nine-carat gold is Hall-marked. By nine-carat gold jewellers understand that the article is made from a substance containing nine parts of fine gold and 15 parts of some other metal, usually copper.

'R.L.'—The words are in my opinion slanderous and actionable. You should, however, obtain sound advice before commencing legal proceedings, which, even though successful, may end in considerable pecuniary loss to yourself.

HOW TO TEACH COMBINED TIME AND TUNE FOR THE NEW CODE.

By J. A. McGREGOR,
Music Instructor, Burslem School Board.

TEN years have passed away since the Education Department recognised the value of Music Teaching in Elementary Schools. Quite a revolution has taken place with regard to the musical tastes of the teachers and scholars, but many enthusiasts have insisted that the 'missing link' in our scheme of musical education should be supplied by the introduction of Combined Time and Tune Tests as a part of the Code requirements.

Last year the suggestion was adopted, but the first year's working has depressed many of the teachers of the Elementary Schools.

In our large towns the School Board Inspectors have wisely looked upon the Code requirements as the *minimum* of attainment, and to them the new regulations are only the testing of years of instruction. But in country schools the new regulations will press rather harshly, and the object of this paper is to give a few practical hints to the teacher of these and other schools.

I. The teacher must begin with the lower Standards, and work systematically, step by step.

In Standards I. and II., after the class can sing fairly difficult modulator voluntaries, and also Time Exercises containing pulse and two-pulse notes, then several black-board exercises should be given on the tones **d m s d'**. Example :—

d m d s m s d m d

The teacher must be prepared for many 'blunders,' as we have now nothing to appeal to the eye; all the notes are on the same level. In cases of difficulty let the teacher try this plan

```
        s     s
    m       m       m
d       d       d       d
```

Every exercise may be sung from left to right, and also from right to left.

Having mastered Tune, let the children attempt such a Time Exercise as the following :—

| 1 :1 | 1 :— | 1 :1 | 1 :— | 1 :1 | 1 :— ||

Now the combination of Time and Tune, as shown below, will be attacked readily.

| d :m | d :— | s :m | s :— | d :m | d :— ||

At this stage I must impress upon teachers the necessity of obeying the law of *equal spaces for equal divisions of time.*

I have seen the above test placed on the black-board in this fashion—

(*Bad Spacing.*)

| d : m | d:— | s :m | s : — | d : m | d:— ||

and the scholars have been blamed for singing incorrectly.

It has always been the proud boast of the Tonic Sol-fa Notation that there was an appeal to the intelligence of the learner. The confusion is caused by attempting to write the Time and Tune at the same time.

Let this be the order—

1. Strong accent marks.
2. Weak accent marks.
3. The notes.

Then an appeal can be made to the eye of the scholar.

II. We come now to the work of Standards III. and IV.

After the careful foundation of Standards I. and II. indicated, the work of this Code Division will be rendered very easy. Proceeding on the lines laid down.

Modulator Voluntaries should be followed by black-board work. Example :—

d m r d s f m r l_1 t_1 d s r f m f r d

The teacher may experience some difficulty here through 'steps' being easier than 'leaps.' Divide the exercise in this way—

d m r d | s f m r | l_1 t_1 d | s r f m | f r d

Each section can be mastered, and sung together with the preceding sections; and finally sung as a whole. Remember a double use is obtained by singing from left to right, and then from right to left.

The addition of half-pulse notes to this division can be readily taught by reference to such exercises as below :—

| 1 :1.1 :1 | 1 :1.1 :1 | 1 :1 :1 |
| 1 :1 :1 | 1 :1.1 :1 | 1 :— :1 ||

The combination of Time and Tune producing—

| d :m.r :d | s :f.m :r | l_1 :t_1 :d |
| s :r :f | m :f.r :d | t_1 :— :d ||

Let the black-board always show in the early stages—

1. Note or Tune Test.
2. Time Test.
3. Combined Time and Tune Tests (being 1 and 2 combined).

In a few months the scholars will attack without hesitation a combined Time and Tune Test at sight.

III. The upper Standards will, after the drill suggested in the lower Standards, take very kindly to the exercises of their division.

My advice is to follow the plan of—

1. Tune.
2. Time.
3. Combined Time and Tune.

The endless variety of exercises will often lead teachers astray. The pulse and a half notes present great difficulty in many cases, but in this division the same tune can be presented in many ways. Here is an example :—

1 2 3 4
| d :m | r :d | s :- | f :m | r :l_1 | t_1 :d | s.f:m | r :d |
5 6 7 8
| t_1 :l_1 | t_1 :d | d.m:r.d | t_1 :d | d :-.m | r :d | t_1 :d | —:s |
9 10
| f :m | r.l_1:t_1 | d :— | —:— ||

Contrast measures 6, 7, and 8, but these 'catches' should be avoided in the early stages of the work.

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The earnest teacher will recognise the necessity for bold, clear, accurate black-board work on the lines I have stated in these hints.

Here, by Combined Time and Tune Tests, we have a wholesome fillip to the study of *real* music, for there can be no music without Time and Tune be combined.

For this reason I hailed with pleasure the new requirement, but deeply regretted the action of the N.U.T. in urging for the withdrawal of the official tests. The interest of the scholars will be quickened, and there will be the happy relief from the monotonous drudgery of Time or Tune Tests taken separately. My practical experience confirms this, as the scholars really enjoy singing 'music.'

In the immediate future we shall reap a rich harvest by the intelligence of our *sight singing*, and the benefit will be welcomed by the choir masters and choral conductors of Great Britain.

QUERY COLUMN.

A. Gillies.—Solve :—

1. $\frac{x}{a+b}+\frac{y}{a-b}=2a$,
$\frac{x-y}{2ab}=\frac{x+y}{a^2+b^2}$.

2. $(a+k)\,x+(b-k)\,y=c$,
$(b+k)\,x+(a-k)\,y=c$.

3. $\sqrt{9x+4}+\sqrt{9x-1}=3$.

1. (1) $\frac{x}{a+b}+\frac{y}{a-b}=2a$)
(2) $\frac{x-y}{2ab}=\frac{x+y}{a^2+b^2}$)

(2) $(x-y)(a^2+b^2)=2ab\,(x+y)$
$x\,(a^2-2ab+b^2)=y\,(a^2+2ab+b^2)$
$x\,(a-b)^2=y\,(a+b)^2$
$\therefore y=\frac{x\,(a-b)^2}{(a+b)^2}$.

(1) $\frac{x}{a+b}+\frac{y}{a-b}=2a$
$\frac{x}{a+b}+\frac{x\,(a-b)^2}{(a-b)\,(a+b)^2}=2a$
$\frac{x}{a+b}+\frac{x\,(a-b)}{(a+b)^2}=2a$
$x\,(a+b)+x\,(a-b)=2a\,(a+b)^2$
$2ax=2a\,(a+b)^2$
$\therefore x=(a+b)^2$.
$y=\frac{x\,(a-b)^2}{(a+b)^2}$
$=\frac{a+b)^2(a-b)^2}{(a+b)^2}$
$=(a-b)^2$.
$\therefore x=(a+b)^2$ and $y=(a-b)^2$.

2. (1) $(a+k)\,x+(b-k)\,y=c$)
(2) $(b+k)\,x+(a-k)\,y=c$)
$\therefore (a+k)\,x+(b-k)\,y=(b+k)\,x+(a-k)\,y$
$(a+k)\,x-(b+k)\,x=(a-k)\,y-(b-k)\,y$
$(a+k-b-k)\,x=(a-k-b+k)\,y$
$\therefore x=y$.

(1) $(a+k)\,x+(b-k)\,x=c$
$(a+b)\,x=c$
$\therefore x=\frac{c}{a+b}$.

$\therefore x=y=\frac{c}{a+b}$.

3. $\sqrt{9x+4}+\sqrt{9x-1}=3$
$\sqrt{9x+4}=3-\sqrt{9x-1}$

Squaring each side, $9x+4=9-6\sqrt{9x-1}+9x-1$
$4=8-6\sqrt{9x-1}$
$6\sqrt{9x-1}=8-4$
$=4$
$\sqrt{9x-1}=\frac{2}{3}$
Squaring each side, $9x-1=\frac{4}{9}$
$9x=\frac{4}{9}+1$
$=\frac{13}{9}$;
$\therefore x=\frac{13}{81}$.

Belle.—The population of a certain colony on January 1st, 1888, was 353,760, and on January 1st, 1892, it had increased to 362,140; what would be your estimate of the increase on January 1st, 1893, the rate of increase being assumed to be uniform? (*Matric., June* 1892.)

Let x = Annual increase per cent.

Then $353{,}760\times\left(\frac{100+x}{100}\right)^4=362{,}140$.
$\left(1+\frac{x}{100}\right)^4=\frac{362{,}140}{353{,}760}$
$=\frac{18607}{17688}$
$=1{\cdot}05195612+$
$\left(1+\frac{x}{100}\right)=\sqrt[4]{1{\cdot}05195612+}$
$=1{\cdot}05'19'56'12(1{\cdot}0256$

	1	
202	519	
	404	
2045	11556	
	10225	
20506	133112	
	123036	
		10076.

$1{\cdot}0256(1{\cdot}0127$

	1	
201	256	
	201	
2022	5500	
	4044	
20247	145600	
	141729	
		3871.

Population on January 1st, 1893,
$=362{,}140\times1{\cdot}0127$
$=366{,}739{\cdot}178$
$=366{,}739$. Ans.

Belle.—A balloon is carried along by a current of air moving from east to west at the rate of 60 miles an hour, having no motion of its own through the air, and a feather is dropped from the balloon. What sort of a path will it appear to describe as seen by a man in the balloon? (*Matric., June* 1874.)

The feather, after dropping, will retain the westward velocity imparted to it by the motion of the balloon, and the effect will be that, whilst falling by the action of gravity, it will still preserve a position vertically under the balloon. Thus, though the natural path is a parabola, the apparent path as seen from the balloon is vertically downwards. But this is only whilst the feather remains in the current.

AT the recent Examination for the Degree of Doctor of Laws at London University, one of the four successful candidates was Mr. F. W. Atkinson, a student of University Correspondence College. It is not customary with the Correspondence College to publish the names of their successful candidates, but Mr. Atkinson, unsolicited, desires that any use of his name be made at the pleasure of the College.

"METAL WORK."—A new work by Mr. Leland bearing upon his favourite subject—Practical Education—is a manual of Elementary Metal Work, including bent iron, repoussé, cut metal, and easy silver work. It is written primarily for manual training classes in elementary and preparatory schools, but will probably be found interesting to anyone who has a mechanical bent. Mr. Karl Krall, of Messrs. Barkentin and Krall, of Regent Street, has revised the work while passing through the press. The publishers are Messrs. Whittaker and Co.

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The Warwick Shakespeare: Richard the Second. Edited by C. H. Herford, Litt. D. **Julius Cæsar.** Edited by Arthur D. Innes, M.A. London: Blackie and Son, Limited.

'The Warwick Shakespeare' is a new edition of a selection of the greater plays of the dramatist in separate handy volumes for the use of the student. The distinctive feature of this edition is the attempt to present the plays in their literary aspect rather than as material for philological study merely. This is doubtless the way in which the study of a play may be made most fruitful in the best results of study, and the editors should receive the heartiest congratulations of all who are interested in the study of literature if their efforts meet with the success they deserve. Judging from the two plays before us the aim of the series appears to be very ably directed. The introduction in each case includes a detailed examination of the literary history of the play, information on its date and on the historical basis of its incidents, and a critical appreciation or a discriminative discussion of its characteristics. The notes are abundant and really helpful, and are followed by an appendix full of information on the Prosody of Shakespeare, and a Glossary, 'intended to include all words at which the reader is likely to stumble.' The volumes are neatly got up, and we feel thoroughly justified in recommending them to Shakespearian students.

The New Readers: Book Fourth and Book Fifth. London: A. M. Holden.

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Hereward the Wake. By Charles Kingsley. Abridged for Schools.

Westward Ho! By Charles Kingsley. Abridged for Schools. London: Macmillan and Co.

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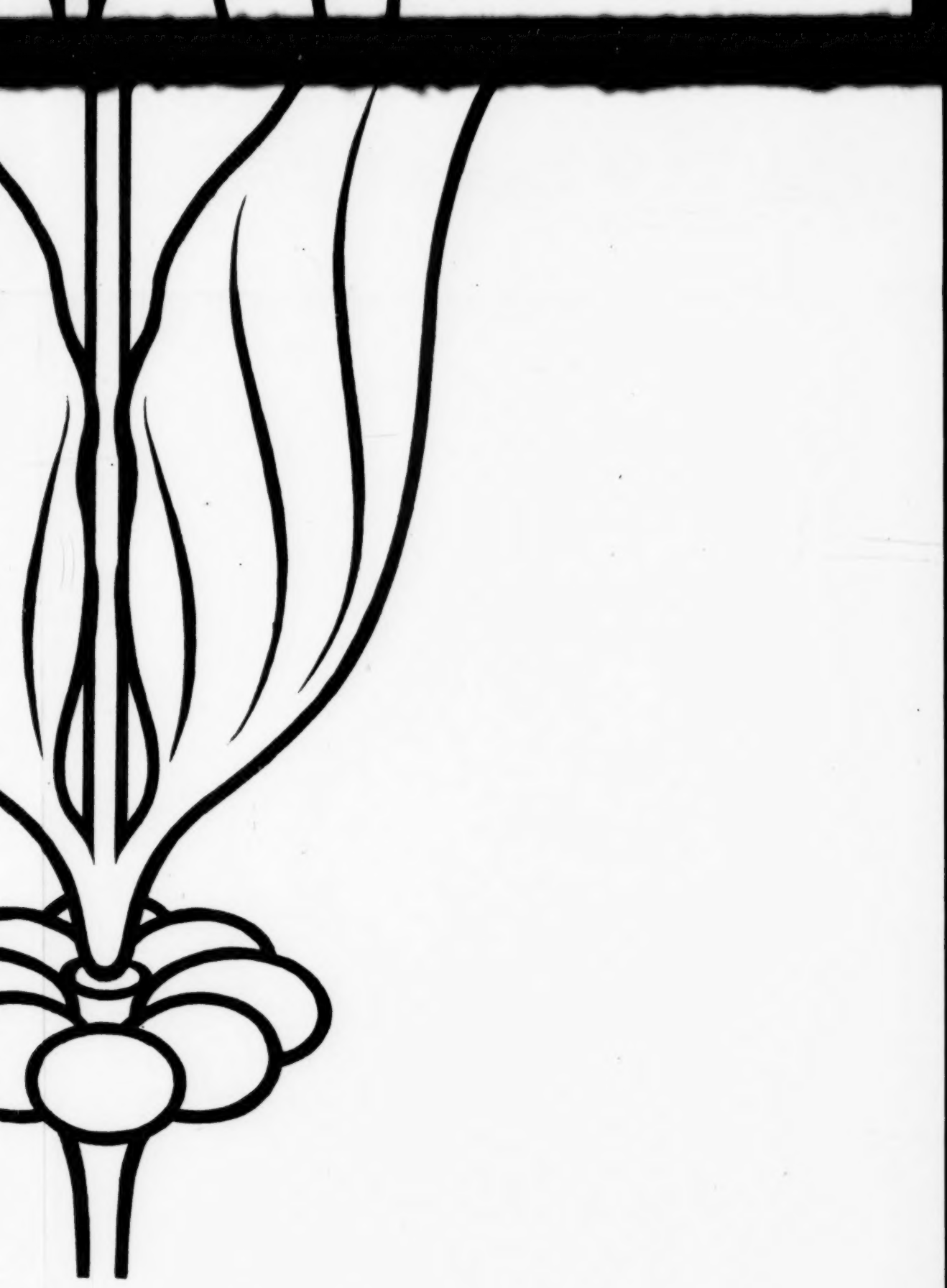

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